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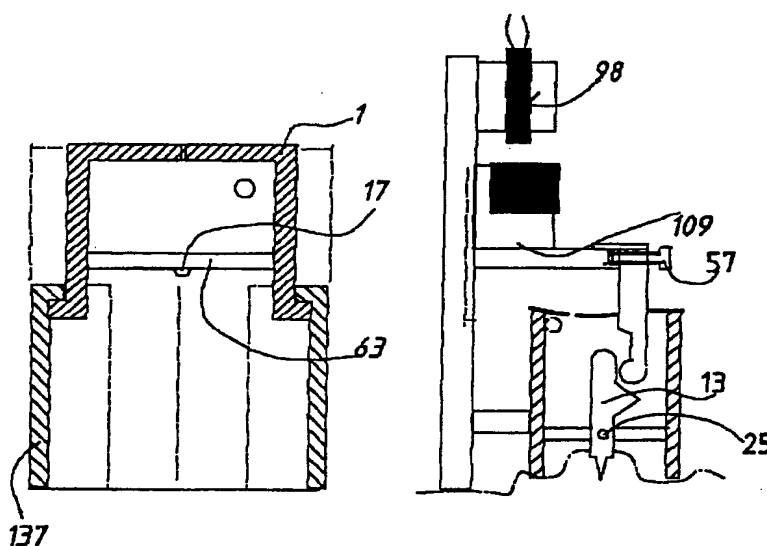
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(54) **APPAREIL ET METHODE D'UTILISATION CONNEXE POUR ASSURER UN CONTROLE DU METABOLISME CHEZ UN ETRE VIVANT**

(54) **A DEVICE AND DEVICE RELATED METHOD FOR A CONTROL OF METABOLISM ON A LIVING BEING**



(57) Appareil et méthode d'utilisation connexe pour assurer un contrôle du métabolisme chez un être vivant ou, dans un sens plus strict, appareil de ponction muni de dispositifs permettant l'enlèvement rapide du point d'insertion après pénétration de la peau pendant un court

(57) A device and a device related method for a control of metabolism on a living being or, in a more strict sense, a puncture device fitted with arrangements, which allow the cutting point to move abruptly after its skin penetration for a preadjustable, short stretch and



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laps de temps prédéterminable, de telle sorte que le sang, qui s'écoule à cause de la destruction du vaisseau, est directement acheminé à un champ d'essai d'un instrument de mesure directement raccordé de préférence, pour la mesure du taux de glucose surtout, préférentiellement à l'intérieur d'une ventouse. Comprend la description de différentes poignées de ponction et de divers dispositifs ainsi que de leurs applications diverses.

whereby the blood, which flows out because the vessel destruction, is directly led to the test field of a preferably directly joined measuring instrument, preferably for glucose, which occurs preferably inside of a suction cup. Different puncture grips and various types of devices and variation of their application are described.



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A B S T R A C T

A device and a device related method for a control of metabolism on a living being or, in a more strict sense, a puncture device fitted with arrangements, which allow the cutting point to move abruptly after its skin penetration for a preadjustable, short stretch and whereby the blood, which flows out because the vessel destruction, is directly led to the test field of a preferably directly joined measuring instrument, preferably for glucose, which occurs preferably inside of a suction cup.

Different puncture grips and various types of devices and variation of their application are described.

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A device and a device related method for a control of metabolism  
on a living being

Background Art

The invention relates to the field of ~~4~~ medical technology,  
especially to the diagnosis of metabolic conditions. The latter  
concerns mainly diabetics and is related to control of the blood  
sugar. The puncture of the muscle flesh on the fingers or foot the  
5 (the latter mainly by children) or on the lobe of the ear to  
obtain blood is very painful, partially awkward, and increases  
danger for sepsis exists on the region of the feet and hands.  
It is the scope of this invention, to effect extraction of blood  
on nearly any skin area, usually painlessly, wherefore the  
10 apparent conditions must be essentially improved.

Prior Art

This invention is essentially supported by the explanations in DE  
15 3806574 A1 (Fig.3,5-13), wherein it was proposed to increase the  
security of the opening of a sufficiently large blood vessel, in  
which the point of a cannula after the prick is put into a  
circular motion in the region of the more deeply situated larger  
blood vessels.  
20 The much more low-priced lancet was proposed as means of puncture,  
which is vibrated along its cutting edge. In the event that such a  
motion did not involve a tilting movement about an axis parallel  
to the skin, the proposed arrangement was less usefull. This is  
still evident by explanation of the "skin which swings with" (page  
25 14, line 24). The retreat of a lancet is described in Fig.55. In  
the disclosure for the opening of the prick channel. Garcia et al.  
(US-Pat.Serial No 4,637,403)

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already propose a corresponding processing in Fig.14,15. The authors are also more particularly occupied with measuring technology and evaluation. But they depend upon the puncture of superficially situated muscles in carrying out their invention. The European Patent Application No. 0301165 A2 repeats the above described examples essentially (with the Fig.39,41-46,49,53,55-58) and applies rotation and vibrational movements, i.e.a multiple oscillation or swinging of the cannula and lancet. Claim 12 concerns a grip for puncture which moves across the skin. DE 37 08 031.8 A 1 is evaluated in the cited Euro-Pat.Appl.with regards to its content. DE 3925940 A 1 expands on the invention with the Fig.13 and 20-22. Also, a turning axis for the lancet is described there, which is situated inside of a sleeve. The lancet shaft has a lateral incision (for the turning axis) with regard to the claim 48; the lancet shaft is in such a way slidable as well in the height,for it can be tilted laterally with regard to claim 53. The lancet springs, laterally connected with the frame of the skin knob by a device with regard to claim 54. A capillary is brought near the lancet point in a groove (by a shaft formation) for the drawing of blood with regard to the claim 55 (Fig.13). A central slot in the shaft is also shown on the Figure. All referred examples are constructed for use in an injector and therefore relatively complicated and susceptible to faults, thus evidently not used by a manufacturer. The injury of the tissue by the lancet or cannula point was disproportionate, because there was not a restriction of the motion and no destination of the velocity of the motion during the movement of the cutting edge of the cannula or lancet point by the apparatus.

Summary of the invention

The solutions proposed thus far did not reach the aim of minimal invasive procedure and resulted in prolonged injury on the subcutaneous cellular tissue - perhaps by the rotation of a cannula or a multiple vibration of the lancet. The injury of a bigger capillary under the skin by a cannula or lancet point may be accidental of course, but already a cutting enlargement enlargement of mostly less than one millimeter is sufficient, if this occurs suddenly enough or if the blood capillaries are prevented from escaping in another manner.

An essential moment of solution of this invention is directly related to the consideration of these factors, namely in most as possible individually adjustable as possible, but in a limitation of the cutting length to the necessary extent, and in a jerky organisation of this cutting movement. Because meanwhile a lot of glucometers are in the possession of the patients, another aim for the applicability (and efficiency) of this device is to elaborate it such a way, that a glucometer, customary in the trade, can be connected directly with the device for a measuring evaluation.

The present invention aims for essential simplifications, whereby the application was already restricted to the diagnostic field by its designated task. Of course, a rod guidance inside of a sealing on the suction cup roof should still be protected by the scope of the invention; but in fact control elements were saved or totally avoided, if possible, through sealings in the suction cup and mainly in the suction cup roof.

This was, done at first, whereby the lancet was changed through the side of the suction cup opening, unless the suction cup itself was a disposable part.

The special elasticity of the skin causes the skin, to be raised much more quickly into the suction cup as a more robust technical membrane, because it can be sunk from the suction cup roof into the suction cup space while underpressure works. A telescopic bar, which is fastened below a back springing suction cup roof, can be excellently used for a lateral tilting of a lancet. The end of the bar - also variably adjustable in the broad diameter by a cam plate - can therefore be moved past on a wedge formed projection of the lancet shaft (and this may be done as well from above with the approach of the suction cup roof from below, if the roof is raised for the suction production, i.e., by spring power). The projection on the shaft can also be horizontal and abruptly toward the point, so as the lifting bar engages there with its end projection and pushes the lancet out of the prick channel during its elevation (Fig.2).

No special additional capillaries are needed to derive blood out of the prick channel through the high elastic skin, if the shaft has adapted shaft broadenings on its surface, perhaps brought about by lamellas with capillary interstices or edge deflections - but also out from a punched out central slot - near to its point. In a special variation, the marginal edge(s) and slot edge(s), which is deflected from the shaft plane, form nearly one (or two) tube(s). The derived blood can be brought in contact with the test field of a sensor, customary in trade (perhaps for the electrical glucose measurement) in such a manner, that the shaft, with its broadside, is brought into contact with the test field in the area of the described lamellas. The test field can also be approached in a usual manner with its stripe-shaped carrier, with a blood drop on the skin after the suction cup is reventilated and removed. A lateral downward flow of a blood drop can be avoided

in addition to the adhesive properties of the lancet shaft which still sticks in the skin whereby the skin knob is pressed downwards bowl-like in its top area by a deeper standing lancet until the reventilation of the suction cup.

5 Such a low-level position of a lancet permits also a jerky movement of a pin laterally against the lancet shaft against a resetting spring, if a so-called 'suction switch' (DE 2551993 from 1974) is used. The angle length for this movement can be adapted to the abundance of vessels of the respective skin by a stop screw  
10 (Fig.2). A leaf spring which overcomes the the head of the shaft causes the return of the shaft in the perpendicular position influenced by a resetting spring (eventually against a stop). This happens because of skin elasticity and its springy-resilience. It is one of the features of the invention, that the tilting axis for  
15 the lancet either is a portion of the device itself or, if the tilting axis perhaps in the shape of an axis nap is a portion of the lancet shaft, that a bearing exists for that nap (and an eventual excavation on the counterside) in a portion of the device. Such an axis bearing can be mounted on a cross-tie which projects  
20 from the suction cup; but the axis bearing can also be mounted in a slot of a partition wall, which is a portion of a (preferably segmented) sleeve, which is shiftable in the height inside of the suction cup.

Favourable for the lateral shock movement is its sudden execution  
25 by a solenoid. The latter works either directly toward the uptake of the lancet (which is especially ferruginous for this purpose) or it moves a plunger with resetting spring preferably with the magnetic anchor . The electrical wires through, coming



a free selected place in the area of the suction cup, offer no problems with regard to sealing. But lancets, respectively their reception, can also be moved suddenly against a skin relatively firmly positioned and across it. This as an alternative to a  
5 tilting axis, into which the lancet is still introduced before the influence of suction (or which works by tilting at the reception of the shaft). This can be achieved through a plunger, the movement of which is caused by a suction switch or by a solenoid, but also by the movement of a cross-tie for the lancet  
10 reception.

Because the averted point of the lancet, which still penetrates the skin, is dulled, the epidermis with its vessels is carried along and not injured during the cross movement of lancet shaft. The prick channel can be held small in such a advantageous way,  
15 which is still essentially increased by the diminishing of the lancet breadth (in comparison with those, which are today customary in the trade) and by the prick into a skin, stretched by the suction.

The test field of a sensor (perhaps one such of the product of  
20 MEDIDENSE or glucometer ELITE of BAYER) can now be contacted directly with the blood exit place still inside of the suction cup and while the skin is raised. The lancet is herefore inserted into the slot of a slide, which is mounted on a cross-tie or serves itself as cross-tie. Thereby a wedge guidance is used in  
25 connection with a vertically moved bar or a parallelly moved plunger, perhaps the anchor of a solenoid, and the lancet is pushed sideways in the direction of the lancet cutting edge. The latter, in the point area as well behind the point, is nearly rectangularly deflected over the test field and crosses to the  
30 length of the shaft. The lancet shaft has a window toward the test field or smaller passages for the blood which tread out of the cutting wound. Finally, the lancet shaft can be totally omitted

and the cutting lancet portion can be positioned directly and firmly on the test field (with or without a strap which clasps the test strip). In the latter case at least the terminal segment of the strip with the test field is intermit-

5 tently moved sideways to the suction cup axis for obtaining blood. The relative skin fixation is better if the diameter of the suction cup is smaller, as by a PEN-like, slender device. But the possibility of the skin stretching is better implemented with a suction cup which has a larger diameter. Therefore a panel with

10 hole can be set before to the lancet point for a skin fixation. The panel with the hole also can be used preferably for a diaphanous skin control with regard of the aptitude for a puncture. Thereby the light beam runs tangentially through the small central skin head,

15 preferably inside of the wall of the cored panel (or of the window). A comparison of the ray diminuation after different applications, but also during the skin motion into the window, can be used for the calculatory control. Knot-like skin alterations indicate that no skin enters into the window of the cored panel.

20 Either the panel with the hole, which is positioned before the lancet point, or the higher positioned carrier plate for the lancet must be fixed first for a skin control with regard of the aptitude for puncture; if the skin area is suitable, a release of the fixation is necessary. Also in consideration is a combined

25 approach of both plates. It can be released by hand with lateral trigger pins (after an acoustic or on another way susceptible sign) by the compression of two keys. The retreat of at least one blocking member by the solenoid, which also causes the impact for the movement of the lancet, is more advisable. (Thereby concomi-

30 tant motion of the lancet during the release of the distancing mechanism for the skin does not present a problem).

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But the object of the invention was also a means for a visual skin control to lower the expenditure. The most simple way therefore is to press a suction cup or a ring with a corresponding size against the skin. The mechanically irritated places of it are marked  
5 thereupon for a certain period. This may be done by a dent configuration or redness. A disk which is suitably shoven upon the suction cup (for the deposit) with a projecting edge and central point, may be useful therefore, because the area of puncture is exactly marked with this method (Fig.15 below). When the skin area  
10 is suitable and when the puncture grip is introduced, the suction cup is put in the annular impression, which is produced by the model ring or by the suction cup rim. Two marking points facing one another are also advantageous and are produced by the depression of two acute bolts, guided inside of bores from straps  
15 on the outern suction cup edge (Fig.11) a transparent casting cylinder( for the mesuring field and the lancet point) is a more costly solution. In this case, a light beam is projected from above from the direction of the glucometer toward the puncture area. The light is reflected by the skin and the image of the  
20 puncture area is visible laterally over an prism or mirror on the grip base. (Fig.23 above). The possiblity to inspect the puncture area before the introduction of the puncture grip with the test strip from above is particularly advantageous. In this case, a special instrument with light guiding downwards and an adapted  
25 ocular lens can become effective through an annular sealing of the suction cup roof. If a swinging lancet is used, the possibility to let wide open the inspection into the suction cup is far more practical. A small lamp with a ray concentration toward the puncture area

can be installed on the base above, but also obliquely in the region of the suction cup wall.

The covering of the suction cup is produced against a further sealing ring above the lid ring in this case, the lid ring being  
5 tightly fastened on the glucometer with slot opening for the test strip haft while pressure works toward the suction cup rim. If there is no a sealing off around the shaft or if the air space inside the glucometer significant, a sealing off around th test strip or puncture grip must be provided in the lid area. This can  
10 be done, also when rotating lancets are used in such a way that above, also very distant from the casting piece around the measuring field, a cylinder radius around the test strip (and tightened onto it) is introduced into a sealing in the lid area. In this case a second sealing below can be omitted, also when  
15 rotating grips are used. The flat test strip can be enclosed as well with two gum plates, which approach one another. When these are pressed against each other, the sealing around the test strip occurs in the middle of the lid, while the lateral tightening is again produced by a special annular seal by pressing on from  
20 above. The approach of the gum sheets can be brought about by a clamp near the inner edges, which is shoved against a wedge guidance outside. But the crosswise closing can also be produced from the outer edges of the gum sheets, when these are compressed, while wedges are shoved in a lateral rail guidance. A rail  
25 guidance can also serve pressure on the lid ring from above, if a corresponding rail guidance exists. The latter functions after the rail guidance for the gum sheets; it is thus mounted on the rail with a greater distance from the device.. The gum sheets are suitable portions of the lid ring, which is lifted along with the  
30 glucometer.

A sealing around the test strip can be omitted, if the glucometer has a seal around the shaft for the introduction of the test strip or if the glucometer has only negligible wake space and a tight housing. In this case, a lid ring can be tightly mounted or  
5 attached around the shaft of the glucometer, so that only a sealing is needed against the suction cup roof, i.e. by an O-ring or washer. If a rotating grip is used, the sealing off toward the suction cup roof can be achieved immediately over the skin knob. The test strip or rotating grip is suitably introduced thereby  
10 from above in connection with the glucometer. Even if the lancet point is excentrically arranged in the skin, this is now efficient, because the rotation movement as well as the swinging movement is diminuated for a short distance, according to the invention. The epidermis is carried along because of its  
15 elasticity, without an enlargement of the cut; because only the area of the point of the lancet is kept sharp. The test strip for a glucometer need only to be embedded in a casting cylinder approximately at the zone of blood admission, with the aim to turn the cylinder inside of a annular seal toward the suction cup  
20 space. It is thereby not necessary that the glucometer itself turns withit, but it can be firmly shoved into a clamp over the suction cup. (The free portion of the test strip on the upper part of the casting piece can join in the torsion movement). The casting piece thereby properly shows a sudden extention of  
25 diameter above the portion, which is destinated for rotation inside of the annular seal, with a lateral flattening or an oval or improved polygonal shape. A rotating portion engages from above like a key, this portion continuing preferrably into a ring, which arches over the suction cup. (Fig.28 , Fig.19 to the right above).

If the derivating wires inside of the test strips are held relatively rigid, nearly the entire test strip can be reinforced by the casting mass and the glucometer is turned on a kind of turn-table. (The glucometers on the basis of current production or  
5 current flow comes into question here as the rule).

The limitations of the rotary motion are various: by pins on the turn-tables or plates, which push against a stop, by an adjusting screw between the the moved and striking portions; as the rule, individually adjustable for the respective skin type. Because the  
10 short intervals of cutting micro or fine threads may be used for the adjusting screws or the choice of a conical end for these adjusting screws, which allow for infinitely variable alterations of the diameter contacting the stop.

The turning itself can be performed inside of a shell structure of  
15 a cylinder assembly. Thereby a rotary spiral spring is tensioned during the pressing down of a projecting portion over an oblique slot guidance. The release of the sector turning is caused by the setting free of the rotary cylinder oder portion which engages with the puncture grip after a fore-running distance of a suction  
20 cylinder which surrounds the suction cup or stands beside it , while a stop member is left after the vacuum influence inside the suction cylinder toward the skin. The same principle of the sequence control is also employed, if the suction cylinder or pump or the folded bellows are arranged crosswise or parallel to the  
25 suction cup axis, coupled with the movement of the vaccum pump driven preferably by spring force. (A corresponding release equipment was still described, also from the rim of the suction cup, on P 25 51 992 on 1974 in the course of continued development.

Two bars can preferably pass along the suction cup or contact corresponding bars, both influenced by springs; this is done outside of the suction producing folded bellows. This contact can be used for triggering of the cutting motion. At least one bar gives thereby the moment of motion to the turn table or plate for the lancet rotation under the influence of spring pressure. This happens, as the rule, on one side, but it is also possible that the second bar participates while a lever transfer is interponed. But this rotation can also be effected manually by at least one bar, which is moved upwardly from above, if from this a lateral projection or its end meets, inside of a gape or on the edge, a corresponding wedge guidance and overcomes it. The wedge profile can also be a partition of the bar. The abruptness of the lateral lancet dislocation is more necessary for the opening of capillaries than for length of the stretch, because the capillaries are not capable of evading a sudden motion. Ball snap like stops can obstruct, at first, the movement of the bar, while the force is stored, in order to realize a higher breakaway velocity. Another solution, which additionally is often the case, is the force of a trigger movement, which aligns first, according to a parallelogram of forces in such a manner against a rotatory axis, that a counter stop occurs in a kind of labil balance. The overcoming latch of a bar can also have a spring, which allows turntable to bounce back, if the spring presses against the dropping shoulder of the wedge profile, after having overcome the steep flank. If the tilting motion is used for the lancet cut

the stabilizing effect of vacuum toward the sealing area in the suction cup roof becomes a problem. It can be thus solved, if the lancet carrier has a regular half radius behind the cutting edge, which is tilted in a likewise arched groove on the suction cup roof. This groove has a slot for the bypass of the lancet edge. The sealing is achieved on the rolling plane, perhaps with spring pressure on the glucometer, which is fitted with the lancet carrier, in the direction of the suction cup. The tilting movement of the glucometer can be effected, on a box like base against a spring over the tension, from a plunger, produced by a gear wheel with an eccentric engaged gear rack.

The skin can also be carried away by turning the suction cup instead of the rotation of the puncture grip. The plunger can be moved through a lateral seal on the suction cup wall to cause a swinging motion on the grip.

A counter plunger inside of the opposite facing wall sealing can serve to limite the cutting length or the return movement of the test strip or grip into the exit position. This can be done perhaps by a belated functioning wedge operation. The test strip is introduced from above through the suction cup roof in this solution. This happens in connection with the glucometer, which is shoved into a kind of clamp on the base. The base plate is tilted over an hinged joint toward the suction cup roof (preferably overcoming an overtaking spring, which guarantees a slight pressure against the suction cup). A seal on the plate or sheet end of the base sheet fits closely thereby with a gum sheet to another gum sheet in the suction cup in such a manner, that



the latter is also tightened around the inserted test strip. The test strip terminates inside the suction cup in a casting piece with lancet point and measuring zone. The cutting movement ensues - as described before - over a plunger, which passes through a seal in the suction cup wall. The plunger suddenly pushes against the casting piece or the casting cylinder, respectively, against the test strip and moves it against a counter plunger, while the plunger itself is activated from outward by a kind of wedge guidance. the counter plunger is adjustable in length from the outside through the seal in the lateral wall of the suction cup. The production of negative air pressure occurs, only per example, an as a variation, by the manual extension of a folded bellows. Just as an example only, the activation of the plunger for swinging the lancet is caused by this movement over a locking catch. This spatial arrangement vera easily permits the insertion of a bloodless vacuum channel cross behind the slot near the cushion with the measuring zone or field, whereby the streaming in of the blood is facilitated. A continuous slot is provided in the casting cylinder for the introduction of the end of the test strip, which is cemented in, in the event it is not casted in (Fig.33, to the right below in the cross section). The length of the casting cylinder, which can also be flattened in the lower segment, is very variable. The suction channel behind the measuring zone can also terminate from below beside a small nozzle o socket which partially surrounds the lancet. An extension of the slot is sufficient, in which the end of the test strip is fastend then unilaterally, if the casting piece, which sourrounds the reaction or measuring plane, continues into the flat test strip. In the slot, the end of the test strip is then unilaterally fastened (also by a belated cementing or shoving in with fitting by a wedge profil).

The underpressure (or negativ air pressure) works aside from the blood toward the test plane, while a cannula or groove lies closed, downwardly in the skin. A plug-in unit through casting technique can be provided up to behind the point area of the lancet for the production of such a groove, in which the plug-in is suitably connected with ledge formed slot of the test strip (Fig.33 on the middle). The lancet can also be conical, because the cutting effect of the conical point of the cone or tap is sufficient for the opening of capillaries.

A sleeve can be provided around the casting piece or the sheet metal with the lancet point to keep free the blood exit channel. This sleeve is shoved after the cutting movement over the lancet point downwards (namely from outside of the suction cup or by a solenoid inside) by a rotating or thrust effect. The skin is thereby shoved out from the lancet and the blood is sampled immediately inside of the sleeve. Such a sleeve is also able to serve for the control of the pricking in depth, which is adjusted still before the prick by the user according his skin type. The swinging or rotational motion of the lancet can also be fixed, if the proper cutting edge is chosen, to make the blood exit channel free. The stretching or extension effect produces thereby a skin fissure against the direction of motion. Because the cutting movement is as a rule, too short in this case, a slow additional or supplemental movement is suitably performed in the same direction without a cutting effect. The return movement of the cutting edge can thereby be made possible in this case against a weak spring, to avoid a cutting extension in the retracting skin, perhaps caused by an unintentionally premature reventilation of the suction cup(Fig.31).

If the cutting motion is effected by the depression of a bar, not only the release of the lancet back motion into its exit position can be coupled with the tension movement of this bar, but also the opening of the reventilation valve for the suction cup (Fig. to the left). The reventilation can also be brought about by the release of the pump plunger catch, mainly if the negative air pressure is manually produced (Fig.24, to the left above) If the pumps are driven by springs, the negative pressure is of course neutralized again by manual pressure against the spring; but the lateral tilting of the device is usually sufficient whereby the suction cup rim is left off.

To ensure that this effect is not produced prematurely, the bridge between the suction cup and the pump cylinder is drawn down to the suction cup rim or a bit deeper. The body surface, which is suitable for the puncture, allways shows a curvature. The broadened bottom side of the device can be supported on this curvature (Fig.28). The reventilation would be effected in this an case by a tilting motion of the device along its broadside as axis or across it to the image plane.

Two pumps with vertical plunger axes parallel to the suction cup axis and embracing the latter can be mounted not to favour a premature lifting of the suction cup by the spring rebound (Fig.28). The bars for the release of the lancet movement are suitably arranged to swivel around an axis for the possibility of their deflection along the device not in use. The depression of the bars gives also a possibility triggering the pumps in the first motion phase. The pumps are connected to each other by a bridge or ledge (Fig.28).

The pricking depth can be adapted to the skin conditions in such a way that a sleeve with an additional seal to the suction cup forms the edge or rim closing. But the suction cup roof can also be lifted or sunk, especially by the help of a thread, while it is additionally sealed to the base plate (or to the base block).  
 5 Finally, a grip or a test strip can dip in different lengths. For this, the glucometer can be lifted by a wedge (or a screw) against the suction cup roof. The height of the suction cup roof with the seal or the depth of immersion of the grip into the seal can also be varied, mainly when rotary grips are used (in the last  
 10 case perhaps by the lifting of the `key`, which grasps, from under, the collar of the roof sleeve.

Two different cutting depths are suitably adjustable, to avoid an additional puncture, if the blood flow fails to appear on the test  
 15 field. A sliding wedge is provided, per example, for this case, against which the bar, which triggers the cutting motion, pushes. If the blocking of the movement of this wedge is released (e.g. in train the hand bar being lifted) the wedge is shoved back during the second longer cut.

20 A puncture grip with a head formed end can also be performed as a device for a single use. A plaster draw with slot for the lancet point can fix the skin in a impression trough against the lancet movement; but the skin can also be drawn up tent-like by means of the puncture grip before the tilting motion.

25 As an example, a solenoid operates a pin with coiled guidance for an optical skin control by means of brightness measurement comparisons in a photometer. This pin directes light through light fibers and/or lenses first toward the skin. If this is free from uncertain shadows (inside of programmed brightness diffe-rences)  
 30 in the puncture area, the solenoid action causes the change of

direction of the light toward an optical glucose measuring zone.  
If a current measuring glucometer is used, it is mainly  
advantageous to fit the measuring instrument with a warning or  
bell signal; in the event the test zone is saturated with blood.  
5 It is not only the glucose, which can be analyzed by a photometer  
or mainly a current measuring instrument (potentiometer or ampere-  
meter). Such an instrument can be used, to control many other  
proper substances as well such as cholesterol, lactic acid, uric  
acid, creatinine or drugs with an appropriate adjustment of the  
10 test field.

Nevertheless, the scope of the invention was not mainly the  
demonstrated single devices, which could be augmented, at will,  
but the functional particularities, which should be protected with  
15 its structural features for its solution in any given combination,  
first and foremost to define the cutting motion, according to  
cutting length and time-period, to a minimum adapted to indivi-  
dual conditions.

The invention continues with the description of the following  
20 examples of embodiments.

Short description of the drawings

Fig.1 above in a longitudinal section, and below in a cross section, reproduces a device for the visual control of the puncture area in natural size.

Fig.2 shows a schematically longitudinal section of an  
5 electromagnetically operated device , in which the cutting motion is triggered from the suction cup roof.

Fig.3 shows, to the left, a test strip in overview, below a cross section is shown through the test field or zone of the test strip as applicable in a device according to Fig.8. The cutting point is  
10 centrally positioned. The variation in the middle below shows an alternative - below in a plan view - with the cutting point lateral to the test zone. Above, a cross section along the section line A - B of the longitudinal section is shown. To the right of it, the variation of a test strip is given, the cutting point of which is extended downwards and positioned in its package. To the  
15 right of it, such a test strip in a cross section, is shoved into a clamp in the area of the test zone.

Fig.4 shows in a longitudinal section a device similar to that of Fig.2, also showing a stop mechanism for the preventing of the  
20 puncture after the optical control of the puncture area.

Fig.5 shows in a natural size, in a longitudinal section, the detail of the drive of a tilting lancet by means of a solenoid.

Fig.6 shows, to a scale of 4 : 1, two variations of a puncture lancet for the derivation of blood. To the right above, the detail  
25 of a cross section is shown along the section line A - B of the longitudinal section.

Fig.7 shows a device with a horizontal and skin parallel cutting guidance, directly jointed to a measuring instrument (glucometer) in a longitudinal section in a natural size.

Detailed explanations are delivered in the lower half; in the middle below a cross section through a vacuum pump along the section line C - D of the longitudinal section above. Entirely to the left, a longitudinal or horizontal section is represented  
 5 through the trigger for the pump. Over this, a vertical section detail is shown relating to the test strip guidance along the section line A - B of the longitudinal section. To the right, the plan view of the test field or zone in a scale of 2 : 1 in two variations is also shown.

10 Fig.8 shows a longitudinal section through a variation of the device similar to that of Fig.8, but it can also be operated without a suction cup. The suction pump as the drive for the cutting motion is omitted.

Fig.9 shows two variations of cutting points for a test strip of a  
 15 device from Fig.8 to a scale of 8 : 1, the variation to the right is installed on the test field. Longitudinal section are given. The cross section beneath the test strip of the variation to the left is drawn on the right in a natural size.

Fig.10 schematizes in a longitudinal section, to the scale of  
 20 2 : 1 a device for the cutting operation by means of the induction of a lateral lancet tilting by a solenoid similar to Fig.5.

Fig.11 shows a puncture device with cutting enlargement, turning in a concentric construction, above in a longitudinal section, below in a cross-section along the section line A - B of the  
 25 longitudinal section, in natural size. To the right, below, a marking mandrel is shown in a detail in the longitudinal section for the visual skin control.

Fig.12 serves to more closely explain the function of a device according to Fig.11 and shows, to the left, longitudinal sections through the left half of the device. Above, a phase of the  
 30 extended folded bellows is reproduced, below a phase before the suction production.

To the left of this, the respective rolling up of the functional

members, for a sudden release of the cutting motion, are shown positioned laterally and over the suction cup roof. The variation of a movement, which is facilitated by a roll at the end of the pin, is shown on the lower left margin of the upper portion of the rolling up. As variations for a limitation of the reciprocal, respective opposing movements, partitions are shown in a longitudinal section detail above the lower portion of the rolling up with a cross-section detail under this with a dovetail guidance. Fig.13 shows, above in a longitudinal section and below in a cross section along the the section line A - B of the longitudinal section, a device according to Fig.11,12, whereby the puncture grip in connection with the measuring instrument is also represented, mainly for the demonstration of the limitation of the cutting motion by an adjusting screw.

To the right, two smaller cross sections are shown through the puncture grip to display two variations of the position of the cutting points or edges with regards to the grip center. To the right of that, the longitudinal detail is drawn as a solution for delaying the rotation through the pin guidance inside of a sleeve substituting the sliding mechanism in the rolling up in Fig.12.

Fig.14 schematically shows, above, in about natural size in a longitudinal section, a puncture device with two bellow pumps lateral to the glucometer in an active position in a natural size. Below, a suction cup is demonstrated as a single use portion combined with a device for the optical skin control as well as for the subsequent gain of optical measuring signals from the test field for the glucometer.

In the middle, the detail of the arrangement for the optical measuring values uptake is visible in connection with the suction cup (as portion for single use) in a scale of 2 : 1 .

To the right, a cross section detail (turned at a 90 degree angle opposite the longitudinal section) is shown through the cutting point, which is surrounded from a gum hose segment.



Below, a horizontal or cross section of the change-over mechanism the cutting point, which is surrounded by a gum hose segment.

Below, the change-over mechanism for the optical measuring operations is explained by the functional members in a horizontal or cross section.

5 Fig.15 above shows a suction cup for single use with a vacuum store connected with a measuring instrument; this is done in a longitudinal section in a scale of 2 : 1. Below, an auxiliary device for the visual skin control is given in a longitudinal section and a respective plan view (entirely below) also in the scale of 2 : 1.

10 Fig.16 above shows the plan view of a puncture device, according to the rotary principle. Both lid flaps for the operation of the bellow pumps are only partially marked in. The suction cup, to the left in the bottom plate of the device is drawn in the middle in a scale 2 : 1 in a longitudinal section. (The glucometer between the clamp is omitted). Below, the functional members of the overcoming mechanism for the sectoral movement of the cutting edge or point is shown rolling up.

15 Fig.17 above shows, in a longitudinal section, a puncture device with an attached glucometer. To the right of that, the small longitudinal detail for the demonstration of the curtain guidance for the cutting motion is also shown. To the far right, a longitudinal section is shown through a sleeve with an appropriate operation bar for the cutting motion. Below that far to the right, the cross section detail is given of the limitation of the cutting motion by a plug-in pin. In the middle, the detail of a triggering seesaw for the suction pump is shown, to the left before, and to the right, after the release. Below to the left, a cross or horizontal section is shown through the base or bottom plate with the bar guidance with a slant fastening the glucometer over it. To the right and below lies the schematical vertical view of a case with the bottom plate and for the deposit of the

operation bars, which are pulled out of the basis plate, in a diagonal arrangement.

Fig.18 above, in a shortened plan view, shows the slides for the sealing lid closing of a suction cup.

5 In the middle, the appropriate longitudinal section is shown, drawn through the suction cup shortly before the seal of an introduced

test strip in the lid area. The possibility of installing an optical skin control device is also demonstrated. Below (turned at  
10 an angle of about 90 degrees) a longitudinal section is shown again through the lid area. Two variations for a regulation of the distance between the suction cup rim and the cutting point are drawn for the suction cup under it, one a half for each.

Fig.19 shows in the middle, in a longitudinal section, a puncture  
15 device according to the rotary principle in a natural size. Above to the left, two variations of the connection to the glucometer are demonstrated, the one to the left side thereby firmly standing, that one of the right variation rotating. The small oval vertical section under the folded bellows of the pump displays  
20 facilitation of the fitting of the folded bellows by means of a socket. In the middle, a cross sectional detail demonstrates a form of limiting the sectoral cutting motion. Far to the right, a rolling up is shown in a longitudinal detail to demonstrate the overcoming mechanism during the cutting motion.

25 Below in a longitudinal section along the section line A - B of the cross section quite below, the triggering between the spring biased bars for the pump and the others for the cutting motion is demonstrated. Between the cross section detail (quite below) and the described longitudinal detail, the small cross sectional detail  
30 of the trigger key for the pump is demonstrated at the phase, when its release is already performed.

Fig.20 is a schematical demonstration of the functional phases of the triggering between the bars of the Fig.19, which occurs in longitudinal sections.

Fig.21 shows in a natural size puncture grips, according to the rotary principle inside of a package sheet or foil. To the left, a grip variation with two cylindrical swellings or extensions (obtrusions) are drawn. Above, a cross section is shown at the level of the test field, below further along the section line A - A of the longitudinal section with the hexagon (far below from the side). The grip, far to the right in the longitudinal section, belongs to that, which is drawn to the left, but it is turned at about a 90 degree angle.

Fig.22 shows a variation of the trigger seesaw in Fig.17 in a lateral view and in a natural size.

In Fig.23 the image of a puncture device with glucometer in a longitudinal section excels in the middle. A swinging lancet is tightened here on its semicircular front side against the suction cup roof. Above to the left, a cross section is drawn through the uptake trough of the glucometer. To the left of that, a puncture grip fitted for a visual skin control is shown, above in a longitudinal section and below in a cross section near the cutting point.

Far to the right, the same grip is shown in a vertical section (also turned at about a 90 degree angle) and below in a cross section along to the section line A - B of the vertical section.

Fig.24 above, in a longitudinal section, and below in a cross-section, shows a puncture device with glucometer, without driving springs, but constructed for direct manual operation.

That is also the case for the pump as well as the cutting motion.

Above to the left, a detail of the seesaw switch is considered

(designed by the arrows) perpendicular to the longitudinal section (according to a cross section, but omitted on the lower cross section).

Below the detail of a longitudinal section is shown through the  
5 bar for the cutting motion, the length of which is controlled, and swinging laterally through the suction cup.

Fig.25 shows in longitudinal details, in natural size, three variations of a lid closing of the suction cup toward the measuring instrument. Below, cross sections are drawn in very  
10 close under the glucometer for the first two examples.

To the left in Fig.26, a puncture device according to the rotary principle is shown above in a cross section and below in a longitudinal section. The small rolling up in the vertical sectional detail at the level of the roof area of the baseplate  
15 shows the mechanism for the carrying the grip (on the cross-section) together with the limitation through the adjusting screw. The small cross sectional detail below shows that a small socket or shell around the cutting point, after the turning of the latter, is shoven against the skin, which is pushed out from the  
20 wound gap. (The skin is not marked in).

Fig.27, to the right, above shows in a cross-sectional detail through the suction cup, an adjustable swinging mechanism for a grip portion, which is preferably rounded below, with a test field and a adjacent cutting point. The longitudinal detail at the side  
25 of the suction cup shows to the left, that the phase before the sleeve around the puncture grip is masked by means of a small spring on the plunger. To the right shows the phase after the forcing away of the cutting point is shown. Below, a longitudinal section bar demonstrates the plunger mechanism for the cutting  
30 motion.

Fig.28, in the middle, in a longitudinal section, shows a puncture device with glucometer for a rotary grip and two symmetrically arranged folded bellows beside the suction cup, the axis of the former running parallel to the axis of the suction cup.

- 5 The glucometer is framed by two operation bars with cross tie, from which one is drawn out as a detail to the left turned 90 degrees about its axis.

To the left of the cross tie, a vertical detail is shown for the explanation of the coupling of the cross tie with the operation  
10 bar. Below that, the detail of the operation bar with a horizontal projecting spring is shown engaging into the stop groove of the stop bar for the triggering of the pump, when the operation bar is sunk. The vertical view in the detail to the right, under the operation bar, shows that clearance was produced for the lowering  
15 of the operation bars and their trigger movement.

Below, the cross section on the upper end of the basis plate is shown, which belongs to the longitudinal section.

Fig.29 shows in natural size a vertical section with the bore for the demonstration of the stop mechanism between the operations  
20 bars of Fig.28. To the right, a variation of the operation bar is pointed out with a special stop mechanism for a jerky cutting motion. A special lid variation is shown for the closing of the suction cup; to the left, in a longitudinal detail, and down below, in a plan view.

25 Fig.30 demonstrates the sectoral cutting motion caused by wedged guidances on the operation bar, a vertical view with rolling up of the sector slot is presented. Below this, a cross sectional detail is shown, and lastly the small cross sectional detail directly on the skin surface with a variation of the cutting point.

Fig.39 shows to the left a cross section through the detail of a suction cup with bar guidance in a more concentric position and a special mechanism for the springing back of the cutting point.

To the right, the mechanism for a puncture device perhaps

5 according to Fig.28 is shown, enlarged and turned about an angle but with swinging lancet. The operations bars are deflected at an angle of about 90 degrees from the vertical into a horizontal position.

Fig.32 shows in a natural size the preparation of the test strip,  
10 customary for the trade, by cutting off of the edge of the test field; patterns for a sheeted envelopment of the test field are further represented as a third theme, countered to the bottom, shown a longitudinal section demonstrating a supplementary sleeve, which can be attached for the regulation of the pricking in depth.  
15 Far below, a cross section is given at the height of the test field.

Fig.33 shows a test strip with a rounded casting piece and indicates again the cutting off of the test field margin in dashed-dotted lines. Under this a withdrawel or plug-in is shown  
20 for the casting piece at a scale of 2 : 1 , in which the plug-in can be replaced upwards. Below this two cross sectional variations exist.

Fig.34, to the left, shows a diagonal view, whereby the operation bar is deflected around a hinged joint before use. To the right,  
25 the belonging plan view is shown (in dashed lines), which is actually a cross-sectional detail with the suction cup and the surrounding bars.

Fig.35 above, in a plan view, shows a sliding mechanism for the lid closing in the suction cup area, to the left being opened, to  
30 the right being closed.

Under this, the variation of such a lid closing mechanism is shown in a longitudinal section, which is opened to the left and closed

to the right. Thereunder the detail of a vertical view to the lid shiver is drawn for applying pressure on the gum sealing ring from above, to the left, below, it is opened, to the right, above, it is closed.

5 Fig.36 shows, in two functional phases, a plunger mechanism for a slowly retarded swinging of the cutting point and for the reventilation. Below, a longitudinal detail is drawn through the grip point and the skin wound.

Fig.37 shows, in longitudinal sections, three variations for  
10 adjusting at the height of the grip in the suction cup. Thereunder, in a longitudinal section, and in a vertical section, a variation is drawn with regard to the regulation of the grip height, by means of a slide.

Beside this, to the right, in Fig.38 a further longitudinal  
15 section variation is represented for a swinging grip.

Fig.39 shows a mechanism for two different cutting lengths for a swinging lancet. To the left, above, the phase before the first  
and shorter cut is represented and to the right, the phase after the  
20 longer reserve cut.

Over that, in each case, a schematical longitudinal section is shown and thereunder a cross section at the level of the locking bolt.

Fig.40, positioned below to the left, shows, above, in a  
25 longitudinal section, and below, in a plan view from below, a special flat puncture grip with a kind of cannula point (see Fig.9), where a gape exists, which opens upwards next to the test field, and the lower margin of the casting piece is closed. In such a way, a pressure gradient develops between the injury place  
30 and the test field, favoring and canalizing the blood stream in the direction of the test field.

Fig.41 represents, on a scale of 2 : 1, above, in a cross-section near the upper edge of the device, and below, in a longitudinal section, a puncture device for two different cutting lengths. The vacuum pump and the measuring instrument generally were omitted as in the last examples.

To the left in the middle, the longitudinal detail is also drawn for a sealing of the puncture grip directly in a semi-spherical roof impression, whereby a slight spring pressure works downward to the puncture grip. There a rotary grip (small cross-section detail below) is used. But also a swinging motion could be used.

Fig.42 are longitudinal sections through a suction cup with a simplified sealing construction for the lid closing in functional stages and in natural size.

Fig.43 shows, on a scale of 6 : 1, above in plan view, in the middle and below, in longitudinal section, a detail of a test strip fitting itself with a tilting mechanism for the puncture point.

Fig.44 shows, in natural size, above, in a cross-section, and in the middle and above, in a longitudinal section, a device for single use

with a special electrical triggering of the cutting mechanism.

Fig.45 shows, in natural size, above in two cross section in different levels, and below, in a longitudinal section, a puncture device for a rotary grip with a special lid mechanism. The middle section details the lid shiver in a side view, to the right, in a vertical view. Well below small longitudinal sections through going through special strip ends with cutting point and test field are shown.



Detailed description of the drawings

Figure 1 reproduces, above, in a longitudinal section and below in a cross section in a natural size, a device for a visual control of the puncture area. The additional equipment of suction cup 1 is omitted. Only a carrier ledge 63 to signify a the positon of the  
5 light source 17 is drawn. The light ray is clearly directed to the central skin spot under the suction cup (there as a dashed-dotted centre line). The suction cup is surrounded for the most part by the surface sleeve 143 , which has a wide aperture. At the exposed functional stage, the latter is torn downward to a  
10 marginal stop so that the lightened central skin spot can be inspected by the wide aperture. The surface sleeve is shoved toward the suction cup (dashed drawn) while the suction cup is sunk for use. Below, a cross section is represented in the overlapping plane of the suction cup and the surface  
15 sleeve.

Figur 2 shows, in a longitudinal section, the left half of a suction cup with the detail of a magnet core 98 of a solenoid, which, however, can also come with an anchor or plunger. The  
20 solenoid influences the sliding bar 109, which depresses the crest of the pin with a subsequent marginal notch against the wedge formed projection of the lancet shaft 13 and thereby effects the short tilting motion of the lancet. The lancet can be tilted around the axle 25 inside the suction cup, the larger diameter of  
25 which permits the skin (drawn with dashed-dotted lines) to invade through the influence of suction (from a suction source, which is not shown).

The advance of the lancet point causes the skin knob to be centrally depressed, in a trough like manner. Blood can be sampled in the

developed depression. The adjusting screw 57 allows for the altering of the cutting length by changing the distance of the wedge projection on the lancet shaft toward the pin crest.

5 Figure 3 shows, in a plan view, a test strip 103 as is customary in the trade mainly for electrical glucose measuring. On the test field 104 both measuring planes are separated here by a gap, through which the point of a lancet shaft 13 projects downwards to the skin, as shown in the vertical section along the section line  
 10 A - B. For usage, the lancet can be moved inside of the slot sideways after the pricking of the skin, while the test strip is fixed. But test strip and lancet shaft may also be connected to at least one hole 138 in the test strip, in which a cross pin of the lancet engages, or they may be connected by clamp to be moved  
 15 together horizontally for the enlargement of the cut. The blood, which rises over the conducting elements behind the lancet point (omitted here), enters the test field directly, whereby colour changing chemicals can also be applied.

In the middle below, a variation is shown, in which the lancet  
 20 point surpasses the test strip laterally (below in a plan view toward the test strip). The longitudinal section over that shows that both measuring or test fields cling on both sides to the lancet shaft with its fine meander like foldings for the blood derivation, the shaft being quite significantly shortened.

25 To the right, the preferred variation is shown in a perhaps naturale size, and this is done inside a dashed lined drawn (case like) packing envelope. The test strip finishes in this case with its small side into the lancet point, which allows a packing in the manner which is usual for lancets and which also facilitates  
 30 the withdrawal without an injury, resp., blunting of the lancet point.

If an electrical measuring method is used - perhaps by a potentiometer - both test fields have a common zero conductor (we have drawn in a divided one) and therefore two measuring wires toward the measuring instrument (dashed drawn for one field).

5 On the cross section to the right, the test strip is inserted into the clamping spring 28 on the slide of a puncture device and may be accommodated more easily in a suction cup than in a transverse position.

10 Figure 4 shows a little pot or cuplet for single use as suction cup respectively closed above and below by a protective foil (dashed drawn). Also demonstrated is the possibility of depressing a folded bellows with a hooked bar 64 to produce a tilting motion on the lancet after the suction is achieved

15 through the suction opening 97. A slight reventilation over the valve 96 allows the hooked bar to rise slightly. The final hook of the hooked bar achieves thereby a profile declination on the end of the wedge lateral projection of the lancet. The lancet is drawn out of the cutting channel in such a manner. The final hook can

20 still be guided away from the lateral wedge projection of the shaft, during its passage along it, by adjusting the adjusting screw 57. The cutting length can be influenced in such a manner. The bottom cylinder, which is shoved into the suction cup, deflects a light ray (with dashed-dotted lines) for the skin control

25 through a small skin bubble in a central hole of the bottom cylinder. (The weak locking of the bottom cylinder perhaps by means of naps at the inner face of the suction cup is not drawn). A stronger suction effect from the suction pump (not shown) causes the skin to raise together with the bottom cylinder into the

30 lancet point, that is, if the result of the skin control was positive. (The measuring arrangement or instrument was also omitted

here).

With Figure 5, the possibility tilting a lancet tilting by means of a solenoid is demonstrated. The magnet core 98 can be activated by the magnet coil 99 the former drawing toward it the magnetic iron 100 in the reception 10 for the lancet to the effect, that the latter tilts about the axle 25 in the carrier ledge.

Figure 6 shows two lancets in a plan view at a scale of 4 : 1. The material from a window excavation 37 is used for a inner bending of the margin 36 at the first lancet, which is done at the same side at which also an outer bending of the margin 35 was performed. A figure resembling a tube for the blood derivation out of the cutting area under the skin is built by the appropriate bending of the margins as demonstrated in the cross section along the section line A - B. Folded or formed lamellas 101 for the blood derivation are shown at the point area of the lower cannula.

Figure 7 is a longitudinal section, in a natural size, going through a puncture device (with a distinct exaggeration of the suction cup diameter). The blood, which is derived by puncture, is fed directly into the test field of a measuring instrument, which can be attached even during the puncture. The suction producing folded bellows 69, with the strong pressure spring 70 in the cylinder cup 111, is installed lateral to the suction cup 1. The folded bellow is shown in a compressed condition. The cylinder cup 111 is connected with the roof of the folded bellows and shiftable between the jaws segments 102 which are fastened onto the suction cup. The piston 2, building the roof of the suction cup, is transformed in such away, that a plurality of tongues 114

project upwards. These are slidable in borings of a inner ledge projection of the suction cup cylinder to prevent a canting. Pins project also from the circular aperture 80 into borings of a such ledge projection of the suction cup cylinder, sectorally

5 dislocated to the piston tongues (detail in the middle below in a cross section). The suction cup cylinder is divided in a upper and in a lower portion by the annular seals 112 . A solenoid with the magnet spoils 99 is installed under the roof of the piston 2 , the anchor of which bears a final sheet projecting into the fork 107.

10 The fork 107 again is a portion of the u-formed sliding bar 109, the lower leg of which is, enlarged, and sheet-like with a rail guidance for the end of a test strip 103 . This is clearly shown on the detail of the cross section (below) along to the section line A - B.

15 When the piston roof, which is connected with the centre of the elastic lid membrane 4 , is placed on the table, the test strip 103 can be laid along of a rail (not shown) on the housing for the battery 83 and the control centre 84 and thereby the test field 104 is inserted under the window of the lancet edge. The lower

20 portion of the suction cup is then placed up with the annular seal and both poritons are connected by two clamps 105 facing one another by means of the marginal ledges 106 . In fact, these ledges are positioned from the drawn in ledge and turned at an angel of about 90 degrees.

25 An end of the bowden cable 108 is fastened with the upper leg of the sliding bar, while the other end serves as a trigger pin 115 , which extends through a notch of the enlarged pin 113 of the central aperture and then enters a gap of a piston tongue 114 (detail quite below in the middle).

30 The cross section through the suction pump, below to the right of the middle, shows the cylinder cup 111 between the jaws segments

102, whereby movement by means of the spring is prevented by the hook on the hand key 110 (see the detail to the left below at a scale 2 : 1 in a horizontal section). As soon as the hook is lifted out of the gap of the cylinder cup against the pressure spring, the folded belows expand. The air inside the suction cup  
5 is derived through the channel 116 . The circular aperture is lifted by the skin and suction so far so that the enlarged pin pushes against the trigger pin 115 (the lowest dross sectional detail). After the optical control (according to Fig.4) is  
10 operated and if the result is suitable, the control centre 84 activates the solenoid with the coil 99 and herewith the bowden cable 108 .

The latter pulls the trigger pin 115. (The light source and sensor are not drawn in here).

15 The trigger pin leaves its gap in the piston tongue 114 and over the enlarged pin of the circular aperture, so that a raising of the circular aperture and a depression of the piston 2 is performed.

The clamp 117 , which engages in a hole (see Fig.3) in the test strip thereby pulls the latter a bit into the interior of the  
20 suction cup. A short period after the contact between lancet and skin is reported to the control center, a second solenoid stroke is activated resulting in the injury of vessels by a sudden lateral shifting of the cutting portions of the point. (The upper  
25 skin layers are only shortly dislocated by the blunt portions of the lancet -as by the lateral marginal bendings up (see Fig.6). The solenoid - and withit the sliding bar - return to its exit position through its springing back motion. The reventilation of the suction cup may be performed by a special valve (not shown) or  
30 by pressure against the cylinder cup 111 of the pump.

Figure 8 shows, above, a longitudinal section through the upper portion of a puncture device similar to that described in Fig. 7. While the sliding bar 119 was moved past there with the lancet under the test strip which was jammed under the annular seal, the lancet with the deflected puncture point as the test strip now are moved together, this is made possible by means of a preformed bending along with the prolongation of the test strip. The wedge guidance of the hooked bar 64 is sunk with its wedged slant for thrust motion through a window in the sliding bar. The driving force is therefore the elastic lid membrane 4, which is sunk with the piston 2 on the sliding collar 8 by influence of the suction (its source is omitted). The working length of the wedge plane and therewith the thrust distance can be regulated by turning a thread on the piston roof from below before use. The device can also be applied without a suction cup. The test strip lays then immediately on the skin in this case. It is also possible to load shorter test strips with blood inside the device and the latter can then be inserted - with the test field in front - into the glucometer as provided in certain glucometer types.

Figure 9 explains, to the left, at a scale of about 8 : 1, the detail of a cutting point, which represents the end of a cannula, which opens on the backside of the shaft 13, in other words, into the short end of the shaft. A blood drop is drawn in there with dashed-dotted lines. To the right, a cross section is shown on the cannula basis, whereby the longitudinal side corresponds to the motion direction during the cutting motion.

To the right, in a longitudinal section, the end 119 of the cannula is enlarged to a funnel, which is mounted to the test field of a test stripe, the test field being traced by gas permeable pores. To the

right on a cross-section, the sieve-like perforation of the test field should be symbolized by very small circles. The blood is directly sucked into the test field in such a manner.

5 Figure 10 demonstrates, at a scale of 2 : 1, a longitudinal section through a suction cup as a puncture device. The lancet shaft is inserted to a perpendicular slot on the sliding bar 109 with its axle inserted into a clamp, whereby the axis nap of the lancet only serves to the fixation on the height. The magnetic  
10 iron 100 is fastened at the upper leg off the sliding bar 109 over an angle piece, which serves as motion limitation for the movement of the lancet. The angle piece is a portion of the carrier ledge 63 , which is connected transverse to the suction cup wall. the magnetic iron can be attracted by the magnet core 98 of the  
15 solenoid to effect a cut through the movement of the sliding bar. The adjusting screw 57 , which is tightened to the roof of the suction cup, works sliding over an eccentric disk against the tension spring 133 opposite the solenoid (on a carriage not shown). The thrust distance can be regulated in such a manner.

20 Figure 11 represents a puncture device in a concentric construction, above in a longitudinal section and below in a cross-section in a natural size. The seal ring 5 is built as a lip seal, the puncture grip therein is omitted. The suction cup rim is enlarged  
25 pot-like and surrounded inside by an annular with the tube segment 156 . An annular excavation takes in the strong pressure spring 70, which props against the roof of the cylinder cup 111 . The latter is tightened below, against the broadest projection of the pot, as well as above, against the smaller tube segment 156 by  
30 means of the annular seals 157,158 . Two symmetrically fitted segment



bridges 159 project from the cylinder cup. The former clings to the latter above, when manual pressure is applied to the projection of the cylinder cup, while the pressure spring being tensioned after the lowering of the cylinder cup along to the tube segment.

5 The higher roofing over segment bridges are dashed drawn in the cross section below, which follows the section line A - B of the longitudinal section. The segment slide 167, which runs rearwards in the wall of roof sleeve, is shown with dashed lines at the center. The stop pin 168 penetrates the perpendicular slot of the segment slide, which is held by the connecting ring 169 (see also on the cross section below). The latter is supported by both cross beams of the segment bridges. The coiled spring 11 lays inside a groove, which almost reaches to the bottom, and surrounds the suction cup. The coiled spring is connected, on the one hand with the basis portion of the firmly standing tube segment, on the other hand with the roof sleeve.

15 The funnel with annular entrance 170 is fitted above true in the tube segment (the lateral passage for the segment bridges is drawn), the screwing to the tube segment is not shown. The retaining clip for the glucometer 171 projects above from the funnel. The manual key 110 is still drawn in, which forms a seesaw. The seesaw, mounted in a axis bearing, is fastened onto the cylinder cup. The lower elastic clamp arm embraces the outermost margin of the suction cup. A actuated pin on the other end of the seesaw projects against a gum seal 160 with central bore on the cylinder cup. If pressure is exerted on the pin of the manual key against the pressure spring 161, the point of the pin is pressed then into the gum seal and tightens its bore; after a short period the end of the clamp leaves the margin of the suction cup.

In this moment, the stronger pressure spring 70 becomes effective and withit the pump function through the suction channel 116 inside of the suction cup. (The suction channel and therefore also the suction cup wall must be dimensioned a bit larger).

5 The hand goes slightly upwards with the pump movement after the start pressure to the manual keys on both sides. In such a way the slipping in of the skin into the suction cup is facilitated (this is effected by the pressure release toward the suction cup edge). But the axis bearing can be also fastened on the outer suction cup  
10 edge and the tightening of the suction channel can be performed there, while the cylinder cup is clamped firmly above. The roof sleeve 143 can be rotated around the suction cup roof with the seal ring, and clings with its inner hexagonal profil around the hexagonal projection of the puncture grip (not shown  
15 here).

The smaller lower cross section of the puncture grip is circularly formed and is enclosed by the lip of the seal ring 5 .

Two straps 163 are shown on the cross section below, which project from the outermost edge of the suction cup and serve the visual  
20 skin control. One of both corresponding marking mandrels 164 is drawn in the detail on the longitudinal section to the right. These mandrel can be pressed against the skin.

After the puncture device is removed from the skin, the impres-  
25 sions on the skin by the marking mandrels are visible still for some time. The condition of the skin can be controlled in the middle of an immaginary connection line between the marking points, because the puncture shall be performed there. The puncture device is put anew on the skin so as both marking  
30 mandrels comes to lay accurately over the skin impressions for blood sampling after

the pressure spring 70 is tightened. It is also possible to bring colour pigment onto the points of the marking mandrels which marks then on the skin.

The above open symmetrical wedge segment slots 165 are visible  
5 inside the roof sleeve 143 for tightening of the cloiled spring 11 ,below in cross section and above in the longitudinal section. The stop pins 168 project downwards into the slots of the segment slides 167 from the connecting ring 170 and are turned from the segment bridge beams at a right angle. The segment slides are  
10 limited in their sliding motion by both guiding pins 172 inside of the roof sleeve, which is thinned out in this area, whereby guiding slots correspond.

Figure 12 explains the mechanism for turning the puncture grip  
15 with two functional stages. This is done in each case, on the left half of a puncture device according to Fig.11 in longitudinal section with schematical details to the right.

The functional details to the right present roll ups of a side view from inside (also from the left). Both segment bridge beams  
20 159, which are enclosed by the connection ring 169 at the upper end of the slopes of their wedge segment slots 165 drawn in behind it (upper picture), corresponding to the stage of the sucking of the skin. The cross pins 166 project into the wedge segments slots from the end of the segment bridge beams. The rolling up of the  
25 latter along the slants of the wedge segment slots can be favored by the rolls 173, as shown below in the detail. Both stop pins 168 are shifted to the left by the force of the coiled spring, and their springing clamp 174 have left the slots of the segment slides 167 which were shoved upwards by these. The guiding pins  
30 172 in the roof sleeve hinder a further raising of the segment slides.

A variation of this mechanism by the overlapping of ledges is demonstrated under it in a longitudinal section; in a plan view thereunder, the fitting of the segment slides by a dovetail is more clearly drawn. To the left, on the longitudinal section, on  
5 can see , that the manual key 110 is pulled up. because the pressure by the finger is released, the bore in the gum seal is open for the reventilation of the suction cup. The turning of the roof sleeve was effected clockwise.

The functional stage, below, corresponds to the depression of the  
10 cylinder cup 111 with the segment bridges while the strong spring 70 is tightened for the suction pump. The cross pins 166 in the wedge sement slots are sunk nearly down to the end of their narrow-  
ed vertical slot by means of the beams of the segment bridges. The stop pins 168 penetrate the slots of the segment slides during  
15 the counter-clockwise turning for the tensioning of the coiled spring. The stop pins have depressed the segment slides, further than that chich gravitivity still has effected, and penetrate nearly to the end of the vertical slots. The depression of the segment bridges is achieved and secured against  
20 turning.(The respective precaution is given with the passage of the segment bridges in the annular funnel 170 and by means of the pressure of the spring 70).

Figure 13 shows the puncture device according to the Fig.11,  
25 above again in a longitudinal section at the functional stage of the released spring 70 after the roof sleeve 143 was turned in a natural size. The puncture grip below 175 has below a slight eccentric point. The puncture grip has a circular diameter inside the seal ring 5 around the test field and it is enlarged upwards  
30 with a sudden extension of caliber into a hexagon, embraced by the roof

sleeve. The puncture grip can continue upwardly into a smaller test strip 103, the end of which is introduced in a glucometer. The latter is fixed in its position by a holding clamp 171 which projects from the annular funnel. The adjusting screw 57 runs on a  
5 slant above the cylinder cup 111 through the tube segment 156 . The adjusting screw was turned at a 90 degree angle around the pitchure: it lies behind it and projects with its conical end into the segment slot 177 of the roof sleeve, as shown below on the cross section in the section level A - B of the longitudinal  
10 section.

The adjusting screw has a portion, which is screwed from below inside, in a slant thread guidance of the tube segment, and terminates in a small square. A knurled screw is stuck on to the latter from outside like a key. The knurled screw has a radial  
15 graduation to a projection line on the upper margin of the cylinder cup. The conical end permits a regulation of the rotary angle for the roof sleeve, which can be accurate within fractions of a millimetre, as given by the stroke of the margin of the segment slot 177 .

20 The cross sections through the lower end of the puncture grip , between the longitutinal section and cross section through the device, show the different eccentric lancet points.

The fitting of a cross pin, which is secured against turning and depressed against a slant edge of a wedge segment slot, serves to  
25 the tightening of the spring for the turning of the roof sleeve which partially embraces the puncture grip. The reversal of movement, when the roof sleeve is raised again, thereby causes the turning of the latter, not at this instant, due a stop pin effect engaging the corresponding sliding segments.

30 The segment slides 167 can also be replaced by sleeves in their engagment with the stop pins 168, in which the sleeves 178 surround these

stop pins and are drawn by the latter out of the bores of the roof sleeve for a predestined distance. (Fig.13, the detail in the middle to the right outside)

5 Figure 14 schematically shows an example of a puncture device with a suction cup 1 for a glucometer 176 which is based on the optical measuring of the grade of blackening of a test field. Two folding bags which are expanded between two sheets 208 , which swivel around a hinge against the torsion spring 218, stuck with the  
10 sheets in a large area. The suction hoses 90 lead out of the folded bags into the suction cup. Before the latter is put on the skin, the upper sheets are compressed against the torsion springs and their spreading out is released whereby the hand supports the glucometer. The rays are projected slantly from  
15 the light source toward the skin of the planned puncture area. A second horizontal ray bundle is drawn in and projected against the test field 104 , when the skin is suitable and sucked on after a signal, and the short turning motion of the puncture grip occurs in the direction of the depressed suction cup roof.  
20 This is more clearly shown in the detail in the middle at a scale of 2 : 1 in a longitudinal section. The elastic hose segment 220 is inserted onto the lancet point for a better blood sampling. The suction cup is fitted with two laterally conical insertions  
25 221 of the wall for the fastening of the glucometer with the auxiliary device and for a ray concentration toward the small test field. Therefore, the glucometer is contained in a ring shaped housing up to the oval passage for the suction cup. Into its wall insertion a plug of the glucometer housing is inserted. Locking is achieved from the left side by the conical and  
30 springing retaining bolt 222 .

The slightly enlarged schematical cross section, below, shows the change-over mechanism from the optical skin control to the metabolism measurement.

5 A light ray, which is symbolized by a dashed line, projects from the light source 17 to the prism 224, which is mounted on a turnable rounded pin. The light bundle is projected after being collected by a lens either to the skin or to the test field. (The path of rays behind the lens is very shortened). The reflected light is collected by a second lens and transmitted over the prism  
10 to the photo sensor 223 for the measuring. The turning of the prism - which is securely beared against a lateral shifting- is produced by the stroking shifting to the right of the magnet core 98 over a retainer pin 226 in the coiled groove 225. This magnet activation is effected first, when the skin control is finished  
15 with a positive result with signal emission for the further operation. The annular groove of the valve plunger clings with the openings of the suction hose, when the valve plunger of the check valve 197 is shoved against its spring by the magnet core, so that the skin is raised inside of the suction cup. (For simplification, the check valve is omitted in the longitudinal section above).  
20 For the same reason, the electronic control center and the battery and the wires are not drawn in the cross-section below).

25 Figure 15 shows, above, in a longitudinal section at a scale of 2 : 1 , a puncture device which uses a vacuum storing cuplet. The trigger pin 228 projects from the under pressure storing space 227 through the suction cup space until its marginal area. The passage for the insertion of the puncture grip with a slightly eccentric cutting point lies in the center, whereby the grip is  
30 tightened toward this passage. The protective foil 216 is withdrawn before use on the skin. The protective cap around the end of the test stripe 103 was yet removed and the test strip was introduced into the shaft of the glucometer 176 .

The latter is thereby held by the retaining clamps 171 on the swivel plate 219.

For the usage, the suction cup 1 is placed on the skin after the withdrawal of the protective foil 216. The skin is accumulated  
5 in this way inside of the suction cup and lifts the trigger pin 228 . The seal of the latter toward the suction roof, is closed by wax, positioned in a small socket, and broken off. The air can escape from the suction cup space to the under pressure storing space, caused by the conicity of the pin broadening upwards.  
10 In this way, the skin is raised into the cutting point. Now, the glucometer with its swivel plate is turned, whereby a marginal projection 230 at this plate overrides, by jerks, a nap 431 on the suction cup roof up to the next nap. A different turning radius may be obtained by an increase of the nap height with several  
15 exercises with regard to strenuous effort. The suction cup is tilted away , if there is no adhesive strip over a wall bore, which can be dissolved (not shown).

Above, first in a longitudinal section, then in a lower cross section at a scale 2 : 1 , a skin control disk with an annular  
20 edge and a central marking mandrel is shown. If this device is pressed against the skin, an impression remains into which the suction cup can be placed for use. The skin control disk is suitably transparent, perhaps with a magnifying lens in the center, so that the punction area can be judged more exactly.

25 Figure 16 shows, schematically, mainly in the details in about natural size, a solution example turning the suction cup while the puncture grip (in the middle in a longitudinal section) stands still. On the schematical plan view above, the basis 232 is shown,  
30 on which the glucometer is placed in the retaining clamp



171 . Only parts of the sheet pair 207 , which projects upwardly along the glucometer, are indicated and the counter sheets parallel on the broadsides of the baseplate are omitted as well as both folded bags, which are widely spreaded, connected with both sheets for a production of negative air pressure in the suction cup 1 . Two columns 233,234 loom up along the glucometer from two edges of the baseplate, around which the sheets for the suction production are spread outward by the tension spring 235 . Before, they were compressed together and in a parallel waiting position clamped with each other (not shown). The vane sheet 236 swivels out under the basis plate and passes under the left projecting margin of the suction cup 1 (see the longitudinal section). After the fold bags are expanded, the vane sheet activates the turning motion of the cutting point. On the longitudinal section (in the middle of the page), the glucometer is omitted and only its retaining clamp 171 is marked in as well as the projecting end of the test stripe 103 is tightened in a annular seal of the suction cup roof 237 . While the baseplate 232 on the glucometer is held fixedly, the suction cup roof can be rotated. An additional annular seal 238 is therefore necessary near the edge of the suction cup 1 . The basis of the suction cup itself is secured against turning by pressing against the skin (not drawn). The rotation is achieved by the coiled spring 11 , one of its ends being connected with the suction cup roof, while the other end is fixed on the roof sleeve 143 - in this case actually a ring. The turning of the roof sleeve is prevented by a locking pin 239 which is pressed by means of a spring into a wedge gape under the roof sleeve. The locking pin is guided through a

bore in the projecting collar of the suction cup 1 .

(The function is below explained to the right in a roll up stretched somewhat higher). The locking pin is lead and retired over the wedge guidance 240 on both sides of the slot segment 241 . (Above in the longitudinal section).

To the left, the condition of the release of the power transfer from the roof sleeve 143 to the suction cup roof 237 is shown. This is achieved by lowering the locking pin 243 from the wedge projection in an annular groove of the suction cup roof.

10 The retreat of the locking pin 243 is performed through the influence of the leaf spring 244 , at the moment when the turning of the roof sleeve brings the locking pin, which can slide into a bore here, over the wedged trough of the sector slide, the latter being manually slidable by the cross pin 245 and can be firmly  
15 positioned by the adjusting screw 57 against the suction cup roof. The drawing of operation space for the sector motion is exaggerated with the dashed ring segment). Below, the functional mechanism is shown again in a laterally roll up with the wedge guidance 240 under the locking pin 239 .

20 For the tensioning of the coiled spring, the suction cup roof is turned counter-clockwise on its margin which is preferably serrated. In such a way the locking pin 243 and the gape for the locking pin 239 are also positioned in an arresting position. (The hose is between the bags and the suction opening 97 into the  
25 suction cup are omitted.)

A similar overcoming mechanism can also be installed for puncture devices as described with Fig. 11 - 13, if the return of the cutting point of the puncture grip to the exit position by the elasticity of the skin is desired.

30 Regarding the pump arrangement for the vacuum production,

- the Fig.14 (above) is noted. The radially fitted lamellas (see also Fig.28 below in the cross section) are essential for the turning motion of the skin which surrounds the firmly standing cutting point; the skin is sucked on between these lamellas and thereby segmented. With regard to the triggering of the turning, it should be added that the wedge guidance 240 comes under the locking pin 239 first when the vans meet is ~~clapped out or opened~~ <sup>tipped up</sup> and the fold bag expands.
- Figure 17 shows a puncture device with a lateral folded bellows 46 as pump. Above, a longitudinal section is reproduced in a natural size, and below, a cross-section at the level of the retaining bars 247 .
- The suction channel 116 can be carried also through the large baseplate 232 as a bore, and the nipple can be shortened. The nipple serves for the installation, to diminish the clearance. The pot 248 with the annular seal for the puncture grip diminishes the clearance inside the suction cup. The roof sleeve 143 with a solidly inner and outer portion, including the coiled spring 11 , can be beared on balls, of which only one is shown.
- In this example, there are four retaining clamps, the deflected springing sheet end clings behind a locking margin of the glucometer. To the right of the glucometer , the operation bar 249 is represented in a longitudinal section with an upper cross beam to a second analogous operation bar (not drawn). The operation bar slides into a tube, which has two slots below (or one large slot) for the movement of the cross pins 251,252 , which project, on different levels and angles, from the operation bar. As shown on the detail of the lateral view between the main drawing and the image of the operation bar, the cross pin 251 stands above the marginal notch with the wedge guidance 250 on the roof sleeve.

The latter makes a small clockwise turn, if the pin is lowered. The rotary angle can be fixed by troughs which are marked in millimeters of different length on the backside of the roof sleeve(not shown). A bore is provided in a segmented sleeve 253, 5 which is fixed on the basis plate, for each of these troughs. (Each of the bores is marked by a pin, whereby only one is employed.)

Two seesaws are drawn in between the longitudinal and the cross section with the end of the operation bar over the end of the 10 seesaw 254 , which is rounded and spring-loaded by a pressure spring. The seesaw to the left corresponds to the condition below on the cross section with regards to the longitudinal dimensioning. The seesaw hook 255 is engaged into a trough of the locking bar 256, two of which are connected with the lid 262 of 15 the folded bellows, which is expanded by the pressure spring 70 . The elevated seesaw to the right should correspond to the functional stage to the right of the longitudinal section. The coiled spring 11 must be chosen weakly, because it only serves the reset movement in a counter-clockwise direction. The puncture 20 grip has the cross pin 257 in slotted trough of the roof sleeve. In such a way its upward movement is braked and its rotation guaranteed. The variation of the Fig.22 for a trigger seesaw was indicated to display a more jerky sector turning.

The cross section below shows, that the glucometer 176 stands on a 25 slant corresponding to the arrangement of the bores for the introduction of the operation bars into the basis plate. The section line A - B reproduces the section direction of the upper detail (to the right) through the marginal notch with the wedge guidance. The functional classification of the cross pins 30 251,252 on the operation bars is also clarified.

To the right, a vertical view is given of a case for the store of the puncture device with functional bars, which are stucked besides and the cross beam (with dashed lines) rear the basis plate 232 . The spring 70 must be compressed before use by which is  
 5 pressure applied until the locking notches or seesaw hooks 255 are arrested in the notches of the locking bars 256 .

Figure 18 shows the detail of a special closing of a sliding lid for a better locking in from above toward the skin for the control  
 10 of aptitude. It is a supplement to the theme of the Fig.17. Above, the plan view toward a portion of the outer and upper cover slide 405 and to the inner lateral cover slide 258 (in a breaking up) is reproduced. The gum sheets 259,260 ,which are drawn in a later position, are also shown in dashes, the gum sealing ring 267  
 15 over the suction cup roof is finely hatched. The test strip 103 lies in the center.

The longitudinal section in the middle shows the gum sheets 259,260 shoven together adjacent to the test strip. The gum sheets are provided with a lateral edging of plastic or metal. Such an  
 20 edging favores the lateral movement past the inner cover slide 258 . The latter stands, appropriately at a greater distance than shown here, first under the outer cover slide (above) further outwards, and it is first brought in congruence with the cover slide 405 . The lateral wedges 406 - that is, their wedge  
 25 formed to constantly durable, enlarging profil - press thereby the gumm sheet together around the test strip. The outer cover slide 405 leans, with upper the wedges 263 in pairs, on the boundary ledges 264 and presses thereby the gumm sheets, but also the gum sealing ring 267 , into their retaining notch on the basis plate  
 30 232. The device for the lateral tilting of the lancet point is omitted here.

A device for adjusting the height for the suction cup rim which influences the prick in depth is also described. The annular seal 265 lies very deeply between the screwed in cylinder of the suction cup 1 and the baseplate in the middle plane in the longitudinal section. After clearance for the shifting, a sudden extension of the diameter inwards follows and subsequently, the thread.

On the vertical section of the lid area (below), one of the boundary legs 264 is sectioned and under this, a part of the outer cover slide with both wedges 263 is arranged, one behind the other.

The adjustable suction cup shell 266 is double walled and close off to the lower rim. It passes the annular seal 265 in the suction cup with the inner cylinder. The outer wall cylinder, which builds a U-formed bridge with the inner cylinder over the suction cup 1, is screwed with the outside of the suction cup cylinder (right half of the Fig.)

On left half of the Fig., a variation is shown, in which the annular seal 265 is not installed inside of the suction cup but outside above the thread for the screwing with the suction cup shell 266, which also can consist of one wall. The edge of said shell has an edge with a preferably projecting collar, which closes in projection with the inner edge of the suction cup 1 and roofs over the latter shield like, the distance being controlled by the thread. An arresting spring with notch, with or without rippling of the marginal ledge, can be additionally used to fix the adjustment at the height and to make it touchable and visibly by means of calibration. Because the test strip is introduced suitably, in connection with the glucometer, into the gap between the gum sheets, only subsequently, in this solution, the light measuring method would be preferred also in this case for the skin control.

The light ray is projected for this from the light source 17 onto the skin area in the center of the suction cup. The reflected light is received in the photo sensor 223 and leads toward the photometer and the control center for the delivering of a warning  
5 signal. The photo sensor is only symbolized by a (very small) rectangle with dashed lines for the wire connections.

Figure 19 represents, in a natural size, a further example of a  
10 puncture device, below in a cross section through the middle of the folded bellows of the pump, and above in a longitudinal section with vertical section details to the left and to the right.

Instead of a coiled spring, the grip turning is achieved by the pressure spring 268, which leans on the basis plate having one  
15 axis with the pressure spring 70 for the expansion of the folded bellows 46 on the opposite side of the suction cup. When the locking bars 256 are pressed to the right, while the folded bellows are diminished, a locking key 271 enters into one of the two locking notches, and runs across and perpendicularly to the  
20 locking bar in a bore of the basis plate 232 (see cross-section detail through the locking area) over the lower cross-section. The locking key is thereby raised by the pressure spring 272 between the terminal sheet 277 and baseplate 232 . The sliding bars 275 , whose ends are connected over a cross plate frame the  
25 pressure spring 268 , are locked by means of the restraining bolt 276 , after the the locking bars as well as the sliding bars are shoved inwards. In other words, the restraining bolt is urged from its locking trough in the locking bolt, after the the locking  
trough of the sliding bar was approached to it.

30 This is clarified in the longitudinal detail along the section line A - B , below in a cross-section in a higher level. (The stage before the locking is shown ; the locking stage is described

under C in Fig.20). When a finger presses against one of both locking keys 271 or against the terminal sheet 277, which runs bent on the level of the roof sleeve, the gaps 274 in the locking keys let the locking bars pass, so that the folded bellows 46 for suction production can be expanded by means of the pressure spring 70 . The locking trough in the locking bars freezes the displacement of the restraining bolt 276 out of the locking trough of the sliding bars (stage C of the Fig.38) Thereby the leaf spring bow 278 slides through the influence of the pressure spring 268 to the right, as shown on the segment details in a cross section under the longitudinal section through the device and in a lateral roll up to the right of it. The leaf spring bow presses against the wedge nose and moves it back to the left after the passage of the steep flange of the wedge nose on the sliding bar. Therefore is a prerequisite the fixation of the movement of the sliding bars (one only is used for the rotary mechanism) by the stop of the adjusting screws 57 for the regulation of the turning angle of the roof sleeve. (The leaf spring bow with its function for the reset motion of the cutting point is drawn in the detail to the right in dashed lines). The stop with the adjusting screw 57 is shown on the vertical section above; as seen in the detail in the middle (sectorally dislocated), the adjusting screw, which is mounted on the bar guidance of the basis plate, is directed against a detent at the roof sleeve. The sliding bars are larger than the locking bars, so that the leaf spring bow projects from below into the sector slot of the roof sleeve to meet its wedge nose there(vertical section to the right). While on the right hand vertical section the retaining clamp 171 rests directly on the roof sleeve and the glucometer turns with the sector motion, on the left vertical section, a plate bearing



the retaining clamp, can be turned, connected with the roof sleeve, so that the rotary motion is executed by the test strip, while the glucometer is held tight. A bridge between the basis plate and the plate with the retaining clamp, suitable in this case, is not  
5 drawn in.

To the right in a longitudinal section, the detail of a sticking strip 280 is shown, which can be stuck around the glucometer, so that the retaining clamps can engage behind its wedge profile. The detail of an oval sleeve under the folded bellows corresponds  
10 to a cross section through the longitudinal tube of the nipple with the collar around the suction channel 116 inside of the folded bellows. The oval shape facilitates the screwing of the nipple thread into the baseplate, whereby the folded bellows is fastened, during the mounting. The end of the test strip 103 is  
15 shoved into the shaft of the glucometer 176 . Both leaf springs 281 fix the latter there in its waist 131 against a drawing out of the contacts from the shaft. The extension of the casting portion or piece of the puncture grip leans on the roof insertion 282, which is firmly connected to the suction cup 1 , the roof  
20 insert bearing the annular seal 265 for the uptake of the more narrowly rounded portion of the casting piece 283 . The extension of the latter clings with the hexagon of the roof sleeve by its own hexagon.

25 Figure 20 explains, in a longitudinal section, the locking mechanism between the rear locking bar 256 and the corresponding sliding bar 275 and the restraining bolt 276 in the functional stages A - C . The functional stages are described for Fig.19. The dashed-dotted verticals display the final points of the bar  
30

motions, the arrows indicate the sliding routes. The length of the retaining troughs must be adapted to the function.

5 Figure 21 demonstrates various puncture grips and a kind of package, above in a longitudinal section and below in a cross section slightly enlarged. These declarations regarding the size relate to the conditions which are demonstrated with the puncture devices.: in reality, one will progress to diminish the breadth of the test fields, and perhaps also diminish the  
10 test fields itself.

Additionally, the wall thickness of the plastic tube 284 for the insertion of the puncture grips into troughs and the thickness for the sticking and to withdrawing protective foil 216 for their covering is drawn in an exaggerated form.

15 The cross section through a puncture grip closely positioned above the cutting point 285 allows for the opening of the trough with the test field of the test strip 103 from above, while upwards the shaft 286 for the blood entrance is opened. (under the longitudinal section a cross-section is still along the section  
20 line A - B shown through the hexagon of the casting piece 283 . The longitudinal section to the right shows the broadside of the test strip 103 and its upper end with three contact wires for the insertion into the glucometer.

25 Figure 22 shows a variation of the seesaw switch of Fig.17 in a side view. The cross pin 252 of the operation bar lies upon the roll 287 , the axle of which runs through the end of the prop 288 . The prop is prevented from evading to the right by an angle boost, on which it leans. The labil balance against the pressure  
30 from above is finally surmounted by the evasion of the

roll to the left. The cross pin thereby operates the end of the seesaw 254 against the pressure spring of the seesaw. Therewith subsequent operation of the torsion mechanism for the cutting point is made more abruptly.

5

Figure 23 shows, in the middle above, a cross section through the tube-like frame 179 of the glucometer 176, as demonstrated below in a longitudinal section.

10 The cross section follows the section line C - D of the longitudinal section. The glucometer is pressed downwards by the tension spring tape 191 . The puncture grip is inserted at it end into the glucometer shaft, is thereby pressed with its round end, which projects through a bottom opening of the frame, into the corresponding rounding of the synclinel bent trough of the suction  
15 cup roof. There through a slot the cutting point projects, whereby the slot area has a rail-like shaped inside of a bent roof depression, where the tightening of the suction cup takes place. The rail like forming in the bend roof insertion with the slot for the cutting point is visible below on the cross section.

20 Radial fitted lamellas 185 are also shown, which project downwards from the suction cup roof for the fixing of the skin, which surrounds the cutting area. The skin, which is drawn with dashed-dotted lines, is drawn up into the suction cup. The pressure  
25 spring 70 of the folded bellows of the suction pump is in a respectively relaxed position. The tilting motion for the cutting guide of the cutting point lies in the center of the rounding of the roof depression of the suction cup and takes place from the frame of the glucometer. The frame has axis naps 182 which can move inside of the bent slots 188 . The bent slots are situated in  
30 the wall sheets 290 , which stand almost on the baseplate 232 .

The

tilting motion is exerted by a kind of eccentric bar 291 , which continues in an oblique (directional) bore of the frame of the glucometer into a tension spring, which terminates in the pin 292. This pin is stuck into one of the holes on the gear wheel 293 ,  
5 which have different distances from the gear wheel axis, depending on the desired tilting angle. The drive of the gear wheel is produced by the corresponding sliding bar 275, which is fitted with a rack on its surface. The connection with the sliding bar over the pressure spring (not shown here) corresponds to the  
10 arrangement in Fig.19 (To the right).  
To the left, a vertical section detail demonstrates the manner in what the axis 294 of the gear wheels 293 , which are in this variation driven on both sides by the sliding bars, moves a wheel which firmly fastened axis seat and with holes for the pin 292 .  
15 The axis evades the pin motion in a u-formed bow . If the gear wheel is turned clockwise, the tension spring is first tightened. The spring tension is at first effective against the eccentric pin, if the pin lies near the prologation line toward the eccentric pin. This arrangement favors a jerky tilting motion. The  
20 extent of the tilting motion can be fine tuned at the adjusting screw 57 . The reset motion of the frame with the glucometer ensues by means of the tension spring 296 .  
Above, a puncture grip is shown at a scale of 12,5 : 1, which is fitted for a visual control of the puncture area. The light  
25 source 17 lies in the shaft of the glucometer. The light ray projects in the shaft 297 (vertical section to the right) along the test field 104 to the skin near to the cutting point. The light, which is reflected from the skin through the shaft of the other side of the test field, is rectangularly bent by a mirror or  
30 the prism 224 toward the eye of the observer.. This is done

through a slot (not drawn in) in the wall sheet 290 in the interspace between the glucometer shaft and the basis plate 232 of the puncture device. As shown in the solution example of Fig.28, the suction cup is removably connected with the basis plate by means of two or three tube socket, from which only one is drawn in.

Figure 24 depicts, above in a longitudinal section, and below in a cross section, in a natural size, a solution example for a swinging lancet or grip. As a variation, the driving springs are avoided either for the underpressure production or for the activation of the swinging motion.

The suction cup 1 stands with its rim around the upperhalf of the ruler-like under edge of the pot 298 for the folded bellows 46 and the basis plate 232 . Because the human body has vaults everywhere, and because, additionally, the body springs back everywhere over the puncture area by its elasticity, it is possible to prevent an inadvertently tilting away of the suction cup with premature reventilation by the properly bearing surface of the `ruler` .

The frame 179 for the clamping insertion of the glucometer 176 has axis naps 182 on both sides toward a retaining fork of the basis plate. On the longitudinal section, the frame is slightly tipped up around the axis naps and against the tension of the leaf spring 300 . The extent of a potential tipping up can be limited at a screw 301 through a elongated basis sheet of the frame.

The pot 248 for the diminution of the wake space inside of the suction cup is shown around the test strip 103 , which is introduced into the shaft of the glucometer. The gum sealing ring 267 is effective after the frame with the glucometer is clapped down to the baseplate. The under pressure is therewith produced,

that the folded bellows 46 are unfolded or expanded into the pot 298 by means of the operation bar (which is shown interrupted and shortened). The under pressure, which thereby develops, works over the hose 90 in the suction cup. The folded bellows are tightened  
5 around the operation bar by a sealing ring.

A shortened displayed clearance is provided for the operation bar inside a fork or here inside of the cylinder 303, whereby the operation bar terminates, in our representation, in the shape of a disk inside of the cylinder. The disk maintains its position at  
10 the cylinder end also when pressure is exerted toward the cylinder in the direction of the folded bellows. But only for a such period, until the locking effect of the stop bolts 195 in a annular groove of the operation bar inside the cylinder is surmounted. (In truth, the locking member here is a ball, behind  
15 which lies a pressure spring, the pressure of which against the annular groove can be altered on the adjusting screw). The square sliding bar 275, which is guided in a groove boarding along to the top for the folded bellows, below is shoved into a longitudinal section. Its end is connected by a pin with the cylinder margin.  
20 The movement of the sliding bar obtains a jerky acceleration after the stop catch is released or overcome. The oblique mounted leaf spring 304 thereby pushes away the cross pin 305 on the plunger 306 . The plunger is introduced into the suction cup through a lateral bore and sealed off against the outer air inside the  
25 suction cup wall. Its free end strokes the test strip 103 near to its end and gives it a lateral motion impulse. The length of the sliding movement of the test strip is determined by the stretch, which also has the counter plunger, which is also tightened to the suction cup wall, inside of the

suction cup. This length can be regulated by means of the  
adjusting screw 57 in the thread bore of a socket, which is  
attached to the suction cup. When the movement of the plunger into  
the inner space of the suction cup is locked, the leaf spring 304  
5 evades the end of the cross pin and passes it. The second leaf  
spring, which is mounted in a counter obliquity, brings back the  
plunger over the cross pin outwards, before its passage to the  
cross pin.

So that the folded bellows can not retreat after the stop catch on  
10 the cylinder 303 is surmounted, the backward motion of the  
operation bar 249 is prevented by the locking notch 307 by means  
of the spring loaded bolt 308. The position of this stop catch on  
the end of the pot for the folded bellows is indicated by a dashed  
dotted arrow. Accordingly, the trapezoid bearing 309 for the hinge  
15 of the seesaw beam 310 is mounted on the pot 298 over the folded  
bellows. Pressure toward the free end of the seesaw beam lifts  
the bolt 308 and releases the stop catch at the operation bar for  
the reventilation of the suction cup after the signal is given  
from the glucometer which announces the blood saturation of the  
20 test field. Before new usage, the test strip must be exchanged by  
a temporary clapping off over the suction cup. Then the hand disk  
or cylinder margin on the end of the operation bar must drawn  
back, whereby the the folded bellows diminishes to reconstruct the  
initial stage, which is demonstrated. The broad incision between  
25 the right suction cup rim and the baseplate 262 permits the  
pushing of the thumb in there for comprising the device. A thumb  
loop in front and further above serves the same scope for smaller  
hands.

Figure 25 shows three variations for the closing up of the suction cup roof, mainly when tilting or swinging lancets or cutting points are used.

5 The variation to the left shows a sealing mechanism similar to that described in Fig.18. This is done, in a natural size, above in a longitudinal section, below in a cross section at the level of the gum sealing ring 267 .

10 The gum sheets 260 are there thinner here. A leaf spring 311 leans against its inner contact angle, one against the other. The leaf spring again leans to on a slope of the upper inner cylinder of the suction cup 1 .

For usage, the pot is brought in an adherent contact with the glucometer 176 , with its surface bearing the gum sealing ring 267. This may be done before or after the test strip is introduced  
15 into the shaft of the glucometer (e.g. by a not shown permanent magnets). The wedge extensions of the leaf springs are urged inwards, while the pot is sunk into the inner suction cup space upto two or three stop pins, which project from the suction cup inwards. The leaf springs transmit this movement to the gum sheet  
20 so that the margins of the latter are hermetically closed around the test strip. The tightening outward between the glucometer and the upper suction cup cylinder effects, finally, the compressed gum sealing ring, which stands around in a thin elastic membrane connection with the gum sheets,

25 The variation of the solution in the middle - above again in a longitudinal section, and below in a cross section in the level of the lid ring 312 - consist of the latter, which is tightly stuck around the shaft of the glucometer. After the fitting with the test strip, the lid ring is pressed against the gum sealing ring  
30 267 on the suction cup cylinder by means of lateral elastic clamps 313 , which are attached on the outern wall of the suction cup cylinder.



On the variation to the right (in the longitudinal section), the test stripe has a round profiled enlargement 315 for trapping on the gum sealing ring of the suction cup cylinder. This profile enlargement can be pressed against the former by means of springs.

5 In the upper middle example, a light source 17 is mounted into the suction cup wall for a visual skin control of the puncture area. (The lampholder and its sealing are omitted). Wires lead over the battery 83 over the switch with the manual key 110 for a the closing of the circuitry. But the manual key is mounted similar to

10 a photo release in the baseplate. Before the lid closing, the manual key can be pressed and the skin control can be visually executed.

Figure 26 shows a solution example for the withdrawal of the

15 cutting point from the wound area after the cutting to let the blood flow out more efficiently. The solution relates to the method of the rotary lancet. Above a plan view is represented, under this a longitudinal section, and far below a puncture grip detail at a scale of 2 : 1 .

20 The lever 316 is firmly connected with the roof sleeve 143 , which surrounds, with a polygonal (perhaps a hexagon), the puncture grip 175 , taking along the latter, above the annular seal 265 .

The puncture grip (detail below) is, for example, narrowed in its lower section and it is surrounded by the marginal sleeve 317 on a

25 slidable seat. The upper edge of the marginal sleeve runs on a coiled slope, the leaf spring 318 engaging into the lowest point of it projecting from the suction cup roof. The edged ring grasps through only with one segment 319 and is locked against turning in a slot, which follows to the segment in the turning direction, by

30 the adjusting screw 57 . The thread of the adjusting

screw lies in a bore of the rotary ring 323 which rotates on the suction cup roof. The fixing of the screw takes place through the squeezing effect of the screw end against the annular roof boundary of the suction cup. The springing lever 316 lies over a  
5 segmental coulisse guidance (detail below the lever in a side view), the steep curve elevation of which makes the rotational movement by hand jerky. The coiled guidance of the edge sleeve is chosen in such a manner that the edge sleeve is shoved downwards in the final phase of the rotation. The edge sleeve urges the skin  
10 away from the cutting point. The blood can ascend inside the edge sleeve and is absorbed by the test field (not shown). The introduction of the puncture grip must be performed at the exact angle according to a marking at the upper inner edge of the roof sleeve.

15  
Figure 27 reproduces in a cross sectional detail an analogous mechanism for the lowering of the marginal sleeve for a swinging lancet. Demonstrated also is, how the swinging motion and its reset in a counter swinging motion can occur through the work of  
20 two sliding bars from both sides of the suction cup. The extent of the inward motion of the plunger 306 is here determined by the clearance of the screwed sleeve, secured against turning, for the adjusting screw 57 in its socket, caused by the sliding movement of the leaf spring 304 on the sliding bar under  
25 the plunger. The casting piece with the test field was chosen, as an example, was round. Below, the longitudinal section through the sliding bar shows the gap in the latter, which permits the elastic evasion of the leaf spring 304 from the cross pin 305 . The leaf spring on the sliding bar of the counter side reaches the  
30 cross pin of the counter plunger. The end of the latter urges

back again the casting piece of the test strip. But before that, its resilient fork 322 pushes - through its wedge shoulder over the cutting point - the margin shell downwards. (To the left and right of the suction cup in the vertical section detail before and after the pushing away of the marginal sleeve.)

Figure 28 shows, above in a longitudinal section, and below in a cross section at the level of the upper margin of the housing block or the baseplate 232 in a natural size, a puncture device, which is fitted for a rotary grip.

The suction cup can also be a portion of the baseplate 232, the lower margin of which surpasses slightly downwards the suction cup rim to stabilize the placement on the arched body surface of the employer. Two folded bellows 46 are provided with its pressure springs 70 as pumps. The lid 147, which has a circular shape at this place, leads from the roof of the folded bellows with a cross ledge toward the locking bar 256. The operation bar 249 has the cross pin 250, which engages a wedged shoulder inside of a notch 250 (the middle detail to the right in Fig.17) or, as demonstrated here in a wedged guidance of a segmental coulisse guidance as shown on the lateral detail of Fig.26 without the steep flange, both installations being inside a rotating roof sleeve 143. A further variation is described in Fig.30. The ball bearing 329 is provided. The manual pressure from glucometer 176 is intercepted by the marginal ring 320, which is connected with the basis plate and bears the gum sealing ring 267 toward the lid ring 312, which is stuck around the glucometer shaft. The rounded casting piece of the puncture grip continues upto the glucometer shaft with the flat test strip 103. The glucometer is fastened between the retaining clamp 171. The lid ring of the glucometer is bolted with the basis plate by means of the cover slide 258 (see Fig.18),

on which the gum sealing ring 267 is pressed. The cross beam 325 is connected with the right operation bar over the hinge 324 . After it is deflected, the free end of the cross beam is interlocked into holes of a fork of the left operation bar 249 (to the left in a vertical sectional detail) by means of a leaf spring 326 .

The right operation bar is drawn out in a vertical section.

Although dilocated at the height, both operation bars show the hinge 327 to rectangularly deflect the bars after the use of the device (see the right plan view of Fig.34).

The vertical sectional detail below to the right shows a preferred bearing of the hinge 324 with a rectangular joint nap in a slot 328 of the operation bar as suitable for the function of a bar variation according to Fig.29 (longitudinal section to right).

Far above to the left, two cross sectional details are shown for variations of the construction of the channel entrance dense over the suction cup rim for reventilation. (This is drawn to avoid the slanted guidance, drawn in the longitudinal section on the middle). In the upper variation, the channel opening is protected by an angle against closing due to rising skin. In the lower variation, this is done by a further dislocation downwards. In the variation above to the right, the skin raising is pushed away by a projecting step of the suction cup with slot.

But the most simple solution seems to be the horizontal boring in the longitudinal section (with dashed lines) at the level of the dead angle of the suction cup space, which is closed against outside air by a filling.

On the crosss section below, the adjusting screw 57 is shown in a ledge, which stand firmly on the baseplate. The adjusting screws push against the segment slide 167 , which turns with the roof

sleeve. Both stop balls reproduced by hatching are stored in one of the bores for the release key and bars, serving as their locking mechanism (see Fig.29 in the vertical section). Both locking keys 271 are rigidly connected by the ledge 330 . An oblique arm, with the arresting spring on its end, leads from the latter into the locking notch 332 on the operation bar. The mechanism is fitted with a double-faced symmetry.

The symmetry of the strong pressure springs 70 and its working direction are well suited against a premature lifting of the suction cup caused by a rebound effect. But a puncture device can also be built, in which one of the folded bellows and its service elements are economized.

On the marginal ring 319 in the longitudinal section through the device, the light source 17 is also drawn in, projecting through the transparent puncture grip toward the skin. The reflected light is received by the photo sensor 223 . The electric and signal connections as well as the photometer are not reproduced.

The light source and the photo sensor can also be mounted under the pot 248 .

To put the puncture device in operation, the operation bars are erected. The cross beam of the operation bar on the right is deflected toward the end of the operation bar 249 to the left and is locked to the latter by means of the leaf spring 326 .

The cross beam is now drawn up to the stroke on a pin bolt at the end of a longitudinal groove of the bore in the basis plate (see Fig.39). From applied pressure to the lids of the folded bellows, these are compressed by the stop ball until the lock (see Fig.29). The glucometer is taken away from its lid ring and the

puncture grip is changed, in other words, a new test strip is inserted with its end into the shaft of the glucometer, by the withdrawal of the lid slide (if the separation was not performed earlier).

5 The lid ring is then placed once again on the gum sealing ring 267 over the suction cup and bolt by means of the lid slide. After the optical control was triggered by a switch (not shown) and the aptitude of skin is confirmed, onto which the suction cup is put up, the bow of the operating bars, from which one is  
10 tipped up and closed over the glucometer, is sunk through pressure on the cross beam 325 against the skin. The oblique arm of the ledge 330 is thereby taken with from the locking notch 332 and the locking key 271 after a short electric switch or contact travel. The folded bellows expand through the influence of their pressure  
15 springs 70 and the air is sucked out of the suction cup through the suction channel 162. The skin rises thereby in and beside of the cutting point of the puncture grip. After an almost maximal expansion of the folded bellows, the sinking of the operation bars is released in the ball  
20 catch 334 (Fig.29). The sinking movement for the suction production occurs through the lowering of the cross beam into the slots 328 (Fig.28, vertical detail to the right below). The locking of the downward movement of the operation bars in the ball catches favors the abruptness of further bar lowering.  
25 The cross pin 251 thereby runs over the obliquity of the coulisse guidance and causes the sector turning of the roof sleeve, which is locked by the knocking of the adjusting screw on the segment slide 167. The gap in the lid slide for the passage of the cross pin 251 was not demonstrated. The reventilation after the signal  
30 from the glucometer can follow through a lateral tilting of the device. A special valve for the reventilation is demonstrated in Fig.52.

Figure 29 to the left reproduces a vertical section through the function control locking catch along the cross bore 335 through the basis plate of a puncture device according to Fig.28.

The locking key 271 is elevated by the pressure spring 336 . Its locking notch stands above the (hatched) stop ball, which hinders the movement of the locking bars 256, which connected with the lid 147 of a folded bellows (Fig.28). Such a prevention of motion exists also for the operation bar 249 in the locking notch by the locking or stop ball, which leans to the locking bar.

To the right, the functional stage is shown after the locking key is pressed down. The stop ball was moved away into the locking notch of the locking key by the obliquity of the locking notch. After the locking bar was lifted, its locking notch was mounted into the level of the stop ball to the right toward the operation bar.

Through manual pressure from above on the operation bar, the edge of the locking notch urges the stop ball into the locking notch the locking bar. The latter can rise further because of the long oval shape of the locking notch, whereby the folded bellows expand. The depression of the operation bar occurs suddenly after a power damming up over the stop catch.

To the right of this representation, the variation of a operation bar is shown at a scale of 2 : 1 . The operation bar 249 continues in a shell with fork 338 , the fork pieces of which show the hinge 327 . When the operation bar is sunk inside of the shell, the pressure is first absorbed by the pressure spring 337 between the operation bar and the upper edge of the sleeve. If the stopping of the sleeve motion in the lateral stop catches 339 is overcome, the lowering of the sleeve occurs abruptly. For a simplification of the demonstration, the stop balls are pressed into

the stop catches 339 by leaf springs; but they can also be adjustable analogous to the condition at the stop bolts 195 (Fig.24).

5 The detail below shows a variation for the introduction of the pot 248 with the gum sealing ring 267 on the lid with the clip hinge 340 . The top can swivel off from the entrance of the suction cup (not drawn). The tension spring 341 , which stretches obliquely beside the clip hinge in a trough, stabilizes the final positions of the pot. Above a longitudinal section is shown, and below, a  
10 plan view is shown. Both are in a natural size.

Figure 30 shows a operation bar 249 , which passes through a sector slot (below in the plan view) of a roof sleeve 143 . The lower wedge 342 to the left meets the leaf spring bow 343 to  
15 the left, the latter being fastened on the roof sleeve, and causes the sectoral turning of this bow. When the operation bar is further lowered, the upper right-side wedge at the latter strokes to the right-side leaf spring bow 344 , what effects the counter motion of the roof sleeve. If the sector motion is prematurely  
20 locked (not shown, see Fig.28 in the cross section), the leaf spring bows evade the wedges on the operation bars.

The variation of the enlarged wedge 345 blocks the downward movement of the operation bar during its counter sector motion, which transgresses, with respect to the length, the proper cutting  
25 movement. This is especially useful, if a short one sided cutting edge follows after the cutting point of the puncture grip, as shown below in a cross section inside of a skin area marked with dashed-dotted lines. During the the counter motion with the blunt lancet or grip portion, the latter opens a gap for the outflow of  
30 blood.



Figure 31 shows a cross sectional detail through a puncture device according to Fig.28 in the level of the casting piece 283 of a puncture grip. The latter is moved laterally tilting as a swinging lancet in the gap between the plunger 306 and counter plunger 321 (shown to the right at a scale of 2 : 1 after an angle turning of the suction cup of approximately 22 degrees).

The operation bars with the wedges 342,346 are turned into the horizontal plane for the demonstration. Because the operation bars (which in the reality run perpendicular) are connected by the cross beam 325(Fig.28), the wedges, which are distributed to both bars, contact with the plunger resp. the counter plunger one after the other, this is all done to execute the swinging of the puncture grip. The extent of the plunger movements can be adjusted at the marginal socket 347 ,separated for the plunger and counter plunger with the adjusting screws.

A spring mechanism is also sketched serving to fix the cutting point in a resilient stroke position. The cutting gap is thereby held open for the exit of blood (see the longitudinal section detail below to Fig.34). But if the suction cup is inadvertently reventilated, the skin, which retreats out of the cutting point, cannot be further injured by the cutting point, because the skin margin in the cutting wound erects the cutting point against the weak spring effect. The symmetrically double arranged wire spring 348 is fastened at the inner projection 449 on a middle bow and lies with one end on the wedge projection 350 with the other on the sliding collar 351 before its cross pin. During the operation of the plunger 306 the moment arises, at which the end of the wire spring takes leave of the wedge projection. The other end of the wire spring thereby pushes the outer sleeve 353 into the direction of the casting piece 283 . The outer sleeve way give to the movement of the plunger toward the casting piece, for

tilting the latter (i.e. the pressure of the counter bearing by the counter plunger) and it holds the casting piece in its tilting position to the right by the effect of the pressure spring 354 after the plunger is retired.

- 5 The cross section to the left demonstrates the the arrangement of the bars and stop catches radially to the puncture grip, serving to narrow the puncture device with the resulting in a oblique position of the glucometer 176 between the functional bars (locking keys, locking bars, and operation bars).

10

Figure 32 demonstrates, at a scale of 2 : 1, special equipment of the puncture grip for the regulation of the depth for the pricking in of the cutting point 285 . Above, a plan view demonstrates the manner in which a puncture grip - customary in the trade for the glucometer - can be cut up along to the dashed-dotted line, to

15 ensure the blood entrance inside of a casting piece (not sketched here) into the test field 104 , in which the chemical reaction runs down.

- Below, the pattern of a thin iron sheet is represented, which
- 20 surrounds the test field 104 clinging to it (on the longitudinal section below, quite below in a cross section).

- On the variation to the right, dislocated downwardly, the cutting point 285 is formed similar to a cannula which is rolled in paper-bag like. After the soldering or another form of tight closing,
- 25 the solution corresponds to that which is described with Fig.40 for the casting process.

- At the variation to the left of the pattern, the area of the cutting point is let open toward the suction cup. The tooth wave ledges approach one another. The longitudinal section
- 30 below demonstrates, the manner in which a oval inwards resilient

sleeve of iron sheet 356 engages with a marginal fold into the teeth of the sleeve. Regarding the desired length for the jutting out of the cutting point, the sleeve of iron sheet can be clapped off at its opening by lateral pressure and engages again after it is shifted along the toothed ledge.

Figur 33 shows the end of a puncture grip in a longitudinal section in a natural size, (the size of the cutting point being exaggerated). The test field 104 is opened downwards, according to the the cutting of the test stripe in the Fig.33, and it is embedded into the casting piece 283 . Under this in a scale of 2 : 1, above in a longitudinal section, and below in a cross-section, the manner in which the plug-in unit 357 from above builds as well the slot 358 is shown, which is only opened upwards, as the continuing shaft 359 . The latter can descend to the base of the cutting point forming by this manner a groove for blood derivation. Far to the right, a cross section with a continuing plug-in unit is also represented.

Figure 34 shows the possibility of deflecting the operation bars around their hinges and their arrangement above the baseplate for a puncture device according to Fig.28,29. To the left, a longitudinal section is represented, to the right, a cross-section with the variation of a reflected image arrangement of the bar holes, fitted with a plunger and a counter plunger for a variation according to a swinging lancet type.

Figure 35 shows to the left, one over the other, the mechanism for a follow-up guidance for the cutting point after the jerky cutting motion for an enlargement of the wound gap.

Far below in the longitudinal detail, this follow-up guidance is shown and the open wound gap is visible. The cutting point or edge moves on the level with larger blood capillaries.

5 The operation bar with the wedge 342 for the moving of the plunger 306 contacts the leaf spring bow 360 while the operation bar is sunk passing the cross pin 361 of the valve stem 362 of the reventilation valve for the suction cup. The clearance of the valve stem is limited by its pin in the guide slot 363 . The  
10 extent of the depression of the operation bar is destined by its stroke to the obliquity of the wedge slide 364 . When a further and still stronger pressure is exerted on the operation bar, the wedge slide is urged to the right against a stronger pressure spring and is locked with its front blunting against the operation bar. This stage of the wedge slide motion to the right causes the  
15 slow follow-up swinging and subsequent locking of the puncture point as visible on the lower image. The plunger lies firmly in a position of the displacement to the left. The stop 365 of the wedge slide can be supplemented by an adjusting screw, on which the extent of the shifting of the wedge slide is adjusted (see  
20 Fig.39).

If the operation bar is further raised, the leaf spring bow takes the cross bar or pin of the valve stem with it upwards. The ablong notch 366 thereby bridges the seal ring between the valve stem and the baseplate so that air enters through the ventilation channel  
25 367 .

Figure 36 describes, to the right, a mechanism for the closing the lid of the suction cup. This is done, above in a plan view, and below in a longitudinal section, and to the left in the opening stage, to the right in the closing phase. The gum sheets 259,260  
30 rest on the suction cup roof, contrary to the procedure in Fig.18 .

The puncture grip must also be stuck through the slot between these up to the suction cup space. The gum sheets lay on the top 248 . The gum sealing ring 267 is held in central position over the gum sheets by a mount 388 from the roof clamp 389 .The legs of  
 5 the hairpin-like springing clamp - which runs in bores of the inner margins of the gum sheets, are urged away inwards, while these margins of the gum sheets approach, the test strip 103. The lid slide, which is slotted in the middle for the passage along the test strip, overcomes with its naps 372 on its lower face the  
 10 cross sleeve guidance of the right-side leg of the springing clamp and the left-side leg of the separated springing clamp, which plunges into the latter.

The vertical details far below show, how the lid slide, with its graduated nap guidance, exerts pressure against the gum sealing  
 15 ring (see longitudinal section) in the final position of its sliding motion against the roof clamp and thereby causes the tightening. The glucometer 176 stands in the retaining clamp 171 . The roof complex with the suction cup 1 is fastened in recesses on the surface of the basis plate 232 by means of the tube socket 186  
 20 with end olives and by spring catches.

Figure 37 illustrates structural solutions for adjusting the height of the puncture grip in puncture devices according to the rotary principle. The display occurs in longitudinal sections in a  
 25 natural size.

In the example of the upper image to the left, the adjustment of a height is made by a thread between the wall ring 319 and the roof sleeve 143 . A further sealing ring 373 between the suction cup 1 and a marginal socket of the roof

sleeve, which is drawn downwards, is provided additionally to the annular seal 265. The wall ring is fixed by means of the squeezing spring 374 , which can swivel against the suction cup.

5 In the middle example, a socket is not drawn downwards from the roof sleeve into the suction cup space; that is why the sealing ring 373 in the suction cup - which can also be mounted on the roof sleeve - lies higher.

10 In the example of the image to the right, the casting piece 283 of the puncture grip is conically tapered downwards for a better introduction and tightening. (The lower diameter is determined by the breadth of the test field). The sealing occurs at the lower margin of the folded bellows 375 , the upper margin of which closes up the roof of the suction cup 1 .The dipping depth of the cutting point can be determined from below in the suction cup by  
15 screwing the marginal ring, which supports the lower margin of the folded bellows.

The lower row of images begins to the left with the longitudinal section through an example of the regulation of height by means of the raising and lowering of the elongated rounded portion of the  
20 puncture grip in the annular seal 265 while a wedge-shaped slide 407 is used.

The wedge-shaped slide is shown to the right in a lateral view. It abuts downwards against the suction cup and lifts it by a oblique parallel and slot guidance in the wall ring 319 . The  
25 extent of the shifting is regulated at the adjusting screw 57 , which stands firmly on a retaining arm on the suction cup, controlled by squeezing firmly in a slot guidance of the wedge-shaped slide (lateral view). The small roof sleeve 143 insertes itself into the

hexagonal ring of the puncture grip, and the adjustment can be effected through segment slots (not shown) of the wall ring (on the longitudinal section in front and behind) in a previously described manner.

5 On the longitudinal section of the variation to the right in the second row, the wall ring 319 is screwed outside and above with the suction cup 1 . The wall ring 319 moves into an annular groove of the roof sleeve 143 , which is turns freely in the respectively adjustably heights. The tightening is effected between the  
10 puncture grip and the suction cup roof.

The turning of the puncture grips of the upper image row can be brought about, e.g. over the key sleeve 376 (in the right upper image with the folded bellows), by means of pins from the lower margin of the sleeve, which project into holes (or notches) of the  
15 marginal projection of the puncture grip. For this, an enlarged detail of the left-side half of a casting piece 283 , to the right, with induction funnel and hole for one of the pins is shown.

20 Figure 38 gives an example for a regulation, in height, of a puncture grip with swinging lancet in two composed sections, one half to the right in a longitudinal section, and the other half to the left, in a vertical section in a natural size. The lid 377 , with the retaining clamp (not shown) for the  
25 glucometer over it, is fastened in hooks of the baseplate 232 by means of three tension springs 378 . (Preferrably an engaging retaining ring could be chosen). Marginal clamps 379 connect the lid 377 with the lid ring 380 . The weak tension springs 381 keep a further lid sheet with angle bars 382 in suspension, and can be  
30 slightly suspended in bores of the baseplate. Before the fastening of the tension springs 378, the test strip is inserted

between the gum sheets, which lay on the lid sheet with the angle bars with a rigid edging 261 (Fig.18) and the respective slots of the lids. Then the test strip is introduced into the shaft of the glucometer. Projections and angle bars are then shoved into the  
5 responding troughs of the baseplate. The wedge-shaped slide 257 between the lid 377 and the lid ring 380, analogously fitted as to Fig.37, is shoved against the wedge obliquity (shown to the right in the vertical section) with respect to the desired depth of the puncture grip in the suction cup and then it is screwed on.  
10 After the strong tension springs 378 are hooked in, these lower the lid ring.

The inner obliquity of this (shown to the left in the longitudinal section) compresses both gum sheets tightening against the test strip. The lid with the angle bars 382 is then pressed against the  
15 gum sealing ring 267 . But also a marginal or wall ring screwing can serve for the shifting of height of a puncture grip according the swinging lancet type, like the image to the right in the second row from above. Thereby the narrowing of the suction cup for the annular seal is not necessary.(The sealing can be  
20 performed laterally).

Figure 39 shows an example for the adjustment of two cutting lengths in the event, that an initial triggering of a tilting motion was ineffective. Thereby it should not be necessary, to  
25 remove the lancet or grip point from the pricking area before. This is a more careful procedure especially with respect to the different levels of richness of blood vessels in different skin regions. The device designs is borrowed from that of Fig.34. But in this case, the wedge slide 364 is used to determine the depth of  
30 the depression of the operation bar and therewith also the extent of the displacement of the plunger 306 by the wedge 342 . The working length of the wedge slide 364 is established



by the adjusting screw 57 , the thread of which is rotated in a bore of the final angle of the carriage 384 . Its movement to the left is limited by the stop 385 . The carriage shows the gallow 386 with a locking notch for the end of the locking bar 387 , which is downwards resilient. A further wedge slide 390 runs parallelly. The adjusting screw, which can be turned and fastened on this wedge slide, fixing it, runs through a bore in a ledge standing firmly on the baseplate.

On the image above to the left, which relates to the stage before the triggering of the cut, the adjusting screw 57 is screwed maximally inwards, so that only a minimal lowering of the wedge is possible to the end of the operation bar. In the event, that the glucometer does not signal a blood saturation of the test field, the user only has to pull the operation bar. A premature lifting of the valve stem 362 is prevented by the spring resilient bolt 391 against the cross pin of the valve stem over the basis plate or by another catch. While the operation bar is lifted, its leaf spring bow 360 lifts a cross pin on the locking bar 387 . The gallow 386 -and thereby the wedge slide 364 - is then unbolted (the upper image to the right) and in such manner hardly offers more resistance to the end of the operation bar. It is moved to the right.

The second depression of the operation bar is now limited by the adjustment of the second wedge slide, caused by the stroking of the bar end to the wedge-shaped plane of the wedge slide. The valve stem must be unbolted resp., the additional catch must be overcome before the reventilation through the ventilation channel 367 (Fig.34) .

The raising of the ventilation stem occurs by the transport of its upper cross pin by the leaf spring bow of the locking bar.

The back transport of the wedge slide 364 with its carriage to the

left is effected first, when the operation bar is maximally lifted.

5 The cross strut 392, which is fastened onto the latter, continues into an angle sheet with slot, the length of the slot is adapted to the route of the operation bar. But the slot guidance 393 for the guide pin of the operation bar can be omitted in such a way in this example. In the final stage of lifting of the operation bar, the slotted sheet 394 is lifted by the cross pin on the cross strut 392 . The cross pin 395 in the extension of the above  
10 slotted sheet engages from below into the oblique margin of the carriage 384 and causes it to brought back to the left (that is) from the position in the lower left-side toward that of the upper right-hand image.

15 If the guide slot 393 is omitted, the sealing ring and the oblong notch 366 for the opening of the ventilation channel (see Fig.34) can also be advantageously positioned directly at the operation bar, while the valve stem is omitted.

20 Figure 40 shows, the end of a puncture grip, above in a longitudinal section, and below in a cross-section in a naturale size. Analogously to the representation in Fig.32, the cutting point is a kind of cannula , the cavity of which opens into the space with the test field 104 , the frame being eventually closed upwards.

25 If the cutting point lies inside the skin, an air pressure graduation raises through this arrangement, whereby the slot 358 into the suction space must be opened upwards. The material for the casting piece with the cutting point can be glass, plastic, metal or another material.

Figure 41 shows, above in a cross-section, and below in a longitudinal section at a scale of 2 : 1, a puncture device for two different cutting lengths by use of a puncture grip according to the rotary principle. The section line A - B lies to the left a bit deeper than to the right hand (dashed-dotted line).

The turning moment is produced by the strong pressure spring (396), which is stretched from a pin in the segment slot of the roof shell 143 to a projection on the roof of the suction cup 1 . The turning is limited by the cone of the adjustment screw 57 , which projects into the segment slot 397 of the roof sleeve. The adjustment screw leads through the swivel lever 398 with the hinge 400 on the suction cup and is pulled on by the tension spring 399. There is a second adjustment screw 401 , which is adjustable on thread on the bridge arm 402 and has a bit larger cone than the adjustment screw 57 and is also dislocated slightly against the latter in height and radial arrangement. The bridge arm stands firmly on the baseplate of the suction cup 1 . The swivel lever 398 has a recess for the adjustment screw 401 und projects with its upward resilient roof bow 403 up to the round nap 404 , having a hole for it, as shown in the longitudinal section. The locking key 271 in the half groove of the roof sleeve 143 (cross section below) prevents the latter from the turning. Atfirst, when the locking key is sunk against the pressure spring 336, a gap in the locking key allows for free turning of the roof sleeve (as shown). The end of the segment slot 177 thereby strokes toward the adjustment screw 57 . If after this cutting motion, a confirmation from the glucometer does not register, that blood has been received by the test field, then the swivel lever can be tilted up against the tension spring 399 . The edge of the segment slot then can pass the adjustment screw 57 and can stroke against the adjusting screw 404 .

During the tilting movement of the swivel lever, the oblique flank of the upward resilient roof bow 403 had worked against the round nap 404 on the roof of the roof sleeve. It had urged the latter clockwise back up to its engagement into the locking key, which must also be depressed. This may be effected over a wedge guidance between the locking key and the swivel lever, which is not shown. The suction pump is omitted; only the opening 97 for the suction inlet into the suction cup is drawn in.

To the left in the middle, in a natural size, a puncture device is partially demonstrated with an especially low height of the roof construction. The tightening of the puncture grip occurs, analogously to the conditions in Fig.28 and 41, by its rounding to a respective polished trough in the suction cup roof. But the lower grip end is thereby preferably hemispherical and the roof trough for its uptake is respectively formed. A cannula or a very slightly eccentrically mounted lancet point can be chosen as cutting point and by that a small passage hole in the suction cup can be maintained. The turning of the puncture grip is performed by the hexagon of its marginal extension over the suction cup roof by the roof sleeve in one of the previously described manners. The roof sleeve has cross pins or naps or a marginal ring, which from above press against the marginal extent of the grip. The latter itself is pressed downwards by springs, in connection with the suction cup, to guarantee a tightening of the suction cup roof. A grip with hemispherical end can also be used in another device type as a swinging lancet.

Figure 42 shows, in longitudinal sections, a simplified lid construction for tightening around the test strip, above, while

the glucometer is approached, and below after coupling.

The suction cup wall is rigid, the pointed shaft end 408 of a gum lid, with its end extended downwards around the test strip, is fitted its rectangular introduction slot, the gum lid being stuck  
 5 around the glucometer shaft. The gum shaft is tightly compressed around the test strip by the edges around the introduction slot of the suction cup.

Figure 43 represents a test strip with integrated tilting lancet point above in a cross-section, and below in two functional stages  
 10 in a longitudinal section at a scale of about 8 : 1 .

The lancet shaft 13 runs here horizontally in a slot of the test field 104 and has the cross axle 409 at the end. At the other end of the lancet shaft, its point bends rectangularly downwards (if a  
 15 puncture device according to Fig. 7, 8, or 45 is used this occurs in a corresponding modification against and, finally, into the skin). After the axle, the end of the shaft continues by snapping into the angle plate 410 upwards.

Between the longitudinal sections through the test strip 103, the end of the sliding bar 109 is drawn in, the end of which strokes  
 20 the rounded edge of the angle plate and lowers it. The cutting point thereby displays an averting motion around the cross axle of the lancet shaft. The length of the cutting movement is controlled by the adjustment screw 57 , the cone of which is drawn in. (The  
 25 total mechanism can be supplemented analogous to prior descriptions).

Figure 44 reproduces, in a perhaps 1,5 time enlargement, a  
 30 puncture device for single use. This is done, above in a cross-section along the section line A - B of the longitudinal section below it.

The upper longitudinal section presents the device before use, the lower longitudinal section during use and after the dislocation of the lancet point for the execution of the cut.

The prolonged housing 411 has a factory manufactured under  
5 pressure in its inner space. The suction cup 1 consists of a wall turning inside with a central slot on the roof area. This slot is closed by the lid sheet 412 , which recangularly projects from the test strip and has incisions on both sides of the test field 104  
10 for the suction cup roof. The tension spring 413 is tightened between the housing wall and the end of the test strip. But the shifting to the left is prevented by the plastic cord 414, which also projects from the end of the test strip but stretches, in counter direction to the tension spring, toward the opposite housing wall. A second plastic cord 417 assumes the same bridge  
15 function, but it is not tightened, having its own clearance determined with regard to the stretch. An electric filament 415,416 is drawn through each plastic cord, which allows for the closing of circuitry over a manual key 110,418 for each of the batteries 83,419 . (The wires are symbolized by dashed lines). The  
20 free end of the test strip - tightened toward the housing wall - is introduced into the shaft of the glucometer 191 .  
On the upper longitudinal section with a view toward the broadside of the test strip, the wires for the metabolism measurement are drawn in dashes. (The glucometer is omitted here).  
25 The trigger pin 228, with a possible release tightened in a roof bore of the suction cup, was lifted by the accumulated skin and the suction (see the lower longitudinal section, and compare Fig.33). The skin was raised into the lancet point, which stretches from the center of the test field 104 downwards.

Through the operation of the manual key 110, the plastic cord 415 was heated and brought to smelting. The tension spring 413 has dislocated on the jerky the test strip to the left. This was possible, because the closing of the lid sheet was broken off by  
5 air pressure the equalizing through the bore of the trigger pin. If a longer cut is planned, the manual keys 110,418 must pressed together. The bend in the test strip 103 (see on the cross section) is smoothed by extension at the stage of the lower longitudinal section. The protective foil 216 was drawn away from  
10 the bottom side of the device before use.

Figure 45 shows above on two cross-sections along the section lines A - B and C - D of the lower longitudinal section a puncture device according to the rotary principle.

15 The lid arm, which is only stretched on the longitudinal section, is drawn out nearer to the middle and supplemented by a vertical view to the right. Below in the middle , the details of three grip test field variations are represented at the scale 2 : 1 in a longitudinal section.

20 The screwed in nipple serves (as in Fig.37) the attachment of the folded bellows 46 with its pressure spring 70 at the base plate 232 with the suction cup 1 . The adjusting screw 57 serves the regulation of the wedge slide 364 . For the establishment of a second cut, the adjusting screw is screwed into the thread shell  
25 420, which can be turned from outside. The latter can be adjusted in the plug-in unit 421 . The shifting of the plug-in is locked by the vertical shiftable wedge slide 422 . The test strip runs diagonally into the shaft of the glucometer 191 and this occurs over the wedge slide. The large lid clap 423 and the small lid  
30 clap 424 with its separated cross axes, are held in the direction of the suction cup roof by a strong 425 respectively a weak 426 tension spring. The strap 428 of the small lid clap grasps the

large lid clap with lateral fork beams and has an opening for the locking pin 430 , which projects from the large lid clap.

If the lid claps are closed, this locking pin lies on the flexible end (black) of the sliding bar 275 as long as the folded bellows

5 46 is compressed. If it is released, after the suction cup has been placed on the skin, the locking pin can tread downwards in its slot. But now, the large lid clap is also suddenly lowered. Its sliding fork 432 , thereby turns the test strip 103, working from its margins (see the lower cross section and the detail in

10 the vertical view to the right, exaggerated in the height). According to the test strip it concerns a kind of curved plastic scoop, the round end of which being with the test field and the cutting point laying in a trough of the suction cup. The slightly spring resilient angle of the small lid clap leans on the test

15 field for tightening (see the longitudinal section). The glucometer 191 , introduced into the shaft of which the end of the test strip is positioned on the sheet 433 on balls. The sheet can be turned around the axis 434 . But the sheet 433 can be suitably replaced by two beams with separated axes, which are bend in the

20 direction of the folded bellows, for the period when the device is not used. The lid flaps are symbolized in a closing position by large lines and in a opened condition by large dashed lines. Below in the middle, three variations of a grip end are drawn at a scale of 2 : 1 in a longitudinal section. The grip to the left

25 side and above lies with a circular downward projecting margin in a circular groove (not shown) of the suction cup roof. The cutting point leads through the test field 104 downwards. The wires on the latter are shown as three points.

The lower variation shows the test field 104 embedded in a kind of

30 plastic box , out of which the cutting point opens downwards as a cannula end. The grip is held and tightened upwards in the suction cup roof on the seal ring 5 . The grip lies with a collar-like



edge over the sealing area on the ball bearing 435 upon the suction cup roof. Facilitating the turning is proper also in other previously described puncture devices, if a respective high pressure component works from above. (The finest pressure equalizing openings lateral to the test field and below of the seal ring are not drawn).

The variation to the right shows a grip end for use in a roof construction analogous to that of Fig.41 in the middle to the right. The test field is adapted to the hemispherical closing outline . The pressure equalizing opening 436 is shown closely fitted beside the cutting point.

The grip end can also be supported by a ball bearing on the suction cup roof against it. In this case, the spring power works suitably from the suction cup roof, perhaps with the elasticity of the gum sealing ring for the lid.

Figure 46 represents, in a longitudinal section, at a scale of 3 : 1, a puncture device with a high bearing swinging axis and with the application of permanent magnets. The folded belows 439 are between the suction cup 1 , which extents upwards, and the retaining cylinder 437 for the tightening. The retaining cylinder swivels around the axis 9 , which is carried in front and in back of each gable strut 438 . The puncture grip 175 may be chosen e.g. flat and reinforced and stabilized in the retaining cylinder perhaps also through a rail guidance (not shown). The grip end is introduced into the shaft of the glucometer 191 . The lid ring of this, which is tightened against the shaft, is bolted with the retaining cylinder by means of the cover slide 405, shoved in from behind, also thightened to the retaining cylinder by the gum sealing ring 267 . The permanent magnet 440 below on the retaining cylinder is prevented from moving toward the permanent magnet 441

by the conical bar 444 with the adjusting screw 57 . The permanent magnet 441 can be shoved along a rail inside of the suction cup to diminish the distance between the magnets, and it also can be arrested by the adjustment screw 457 . One of the permanent magnets  
5 can also be replaced by a solenoid. The skin (with dashed-dotted lines) is sucked into the suction cup. The pump is omitted and the opening 97 for air derivation is drawn in.  
Below the longitudinal section detail demonstrates the conical bar 440 with the adjusting screw 57, which is adjustable in a strap of  
10 the slide 442 the shoulder of which strokes against the stop 445 when tension is applied to the right along the rail 443 . The retreat of the conical bar from the glucometer 291 triggers the tilting and cutting motion, the extent of which can be regulated on the adjusting screw 57 . In an alternative manner, the tilting  
15 motion can also be achieved by the quick shifting of a conical bar against the glucometer (while the extent of the shifting can be adjusted). Weaker permanent magnets can also be used for a slightly free fixing of the tilting motion of the cutting point.  
But substances other than glucose can be measured by means of the  
20 puncture devices, which are described with Fig. 1 - 46, by the portion of the test field or by the choice of a test field with a related chemical nature. Such substances could be, for example, acetone, lactic acid, but also alcohol or drugs.  
It is an essential aim of the invention -seen in its totality -to  
25 combine several different functions - any for preparing for use as well as any for activation of the puncture - in one or few manipulations for the user.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of devices for a metabolism control differing from the types described above. Although the examples are limited to the use of mechanical puncture means with a cutting point and have mechanical stop means, the technically already familiar solution of puncture, using laser or electronic steering means, should not reduce the idea (spirit) of the invention, which is presented here.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A device for a control of metabolism on a living being through blood sampling out of the skin by means of the cutting point of means of a a puncture, which is pricked into the skin, preferably inside a suction cup in connection with a suction source whereby  
5 the skin is raised by influence of under pressure, and whereby the cutting point is than moved across almost parallel to the skin surface,  
t h e r e b y i n d i c a t e d ,  
that means are present, to prevent the movement of the cutting  
10 point about parallel to the skin surface, as the rule, to a single and in its lenghts variable cutting movement with a application length from, only in exception, up to ten millimeters,  
and that at least one test field on a exchangeable carrier with chemicals for at least one substance analysis is approaches the  
15 blood exit area in a way, in which the blood, flowing out of a vessel, destroyed by means of a puncture, can push forward onto the test field, whereby the appropriate test field can be connected with a measuring instrument by means of the signal transfer,  
20 preferably with a measuring instrument customary in the trade, and whereby, preferably, means are present for an optical skin control of the skin area, which is determined for the puncture, to avoid a puncture into a pathologically altered skin, including a means of visual control.  
25
2. A method, related to the device of claim 1 , for the control of metabolism on a living being by blood sampling out of the skin by means of the cutting point of a puncture means, which is

pricked into the skin, preferably inside a suction cup in connection with a suction source whereby the skin is raised through influence of under pressure, and whereby the cutting point is then moved across and almost parallel to the skin surface, thereby indicated ,  
5 that the movement of the cutting point about parallel to the skin is limited to an application length of, only as an exception ten millimeters and operated abruptly, to avoid the escaping of blood vessels for the cutting point or edge of the puncture means, and  
10 that at least one test field on a exchangeable carrier with chemicals for at least one substance analysis approaches to the blood exit area in such a way, that the blood flowing out of a vessel, destroyed by the puncture means, can push forward onto the test field, whereby the appropriate test field can be connected  
15 with a measuring instrument by means for the signal transfer, preferably with a measuring instrument customary in the trade.

3. A Device according to claim 1 ,  
wherein means are present, to arrange the movement of the cutting  
20 point swinging or tilting in one plane, thereby to limit its swing, preferably while at least one plunger is introduced through a seal in the suction cup wall, which is inserted from the outside.

25 4. A device according to claim 1 ,  
wherein a sleeve partially surrounds the test field and engages

key-like into the outline of the carrier in such a way, that it moves with the latter by its sectoral turning, the suction cup roof being thereby preferably tightened by a sealing ring about a circular projection of the carrier of the test field, and whereby  
5 an extent of said carrier additionally rests on that which is a means of recucing friction above the sealing for the suction cup roof on a portion of this if the projection of the carrier is larger and braking the movement, whereby in each case the rotation angle can be adjusted to one of the rotary portions by a stop.

10

5. A device according to claim 1 ,  
wherein the cutting movement along the skin surface is effected by a kind of wege guidance between a portion, which is connected with the carrier of the test field at least for a time for the motion  
15 transfer, and at least one bar, preferably over at least one hand bar, which is sunk overcoming an obstruction by a stop before the wedge guidance becomes effective.

20

6. A device according to claim 1 ,  
wherein a tightening between the measuring instrument and the suction cup space is provided,  
preferably a ring, fitted around the shaft of the measuring instrument and around the carrier for the test field, which is introduced into said shaft, the ring of which presses a sealing  
25 ring during its fastening on the suction cup roof, whereby preferably additional elastic portions exist, which effect a tightening around the carrier against the shaft.

30

7. A device according to claim 1 ,  
wherein the sealing of the carrier of the test field and means of puncture against the suction cup roof occurs by the insertion into

the curved end plane of the means of puncture into a correspondingly curved and densely adapted trough above in the suction cup roof, which has an opening for the passage of the cutting point, and whereby a soft pressure is exerted to the puncture means in the direction to the suction cup roof.

8. A device according to claim 1 , wherein a portion connected with a cylinder pump, which serves as suction source, and moved together with the pump plunger, triggers a stop catch against another portion, which stands under spring tension and transfers the movement along to the skin toward the cutting point, whereby preferably the portion, which transfers the rotary motion, leaves an engagement in at least one firmly standing guiding edge, resulting in the release of the stop, if the portion, which turns the carrier of the cutting point radially, surrounds the latter as a sleeve, the portion raised with the pump plunger being in connection with the rotation transferring portion.

9. A device according to claim 1 , wherein at least one lid exists, which is spring resilient and temporarily tightened against the suction cup roof over a clap , preferably with a second clap, which is lifted together with the first clap with a separated weak pressure spring and works, if removed by the first clap, with the pressure of the spring working against the means of puncture, while the first clap with its strong tension closes the suction cup roof, and whereby the clap with the lid has a clearance to lower a further distance, after triggering a stop catch for its further lowering, and thereby pushes the carrier of the test field with its cutting point in such a way, that the latter is moved laterally.

10. A device according to claim 1 ,  
wherein the deflection by at least one magnet effects  
the movement of the cutting point by influence against a portion,  
which is conneted with the cutting point.

11. A method according to claim 2 ,  
whereby the penetration depth of the cutting point into the  
suction cup space can be adjusted, nearly stepless, in the height,  
preferably by adjusting the height of the puncture means  
while the distance between the measuring instrument and the  
suction cup roof is varied.

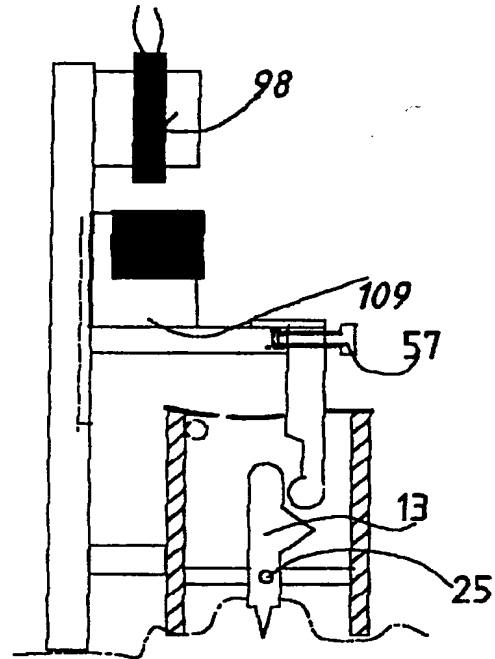
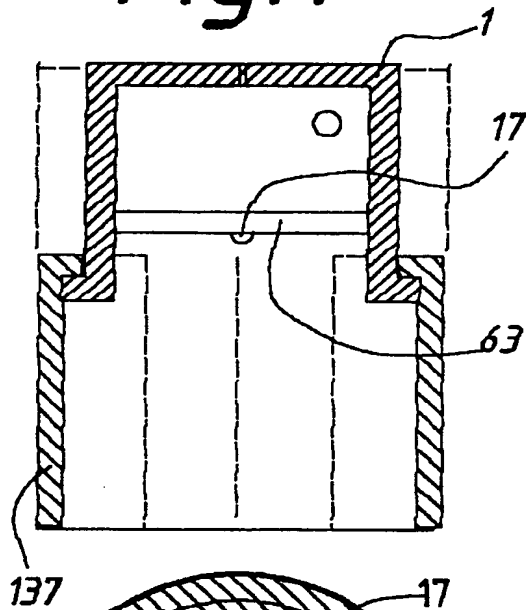
12. A method according to claim 2 ,  
whereby a second movement of the cutting point occurs, which can  
be adjusted in its length, without a repeated prick in and while  
the skin remains raised, and this being done either for a jerky  
cutting enlargement in the event, that a successful signal is not  
registered from the measuring instrument, or more slowly for an  
enlargement of the wound gap for the blood flow, preferably while  
the cutting point is brought back to its start position.

- 95 -

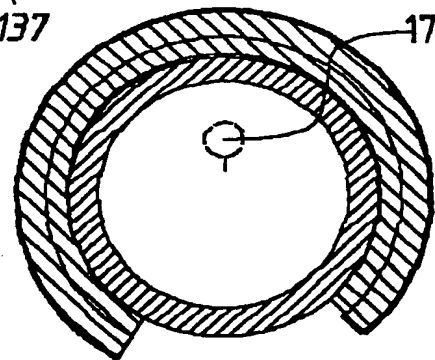
Representative in Cannada: Mr. Magnus Goodmundson,  
Vernon, B.C.VIT 6L7 13/9060 TRONSON RD



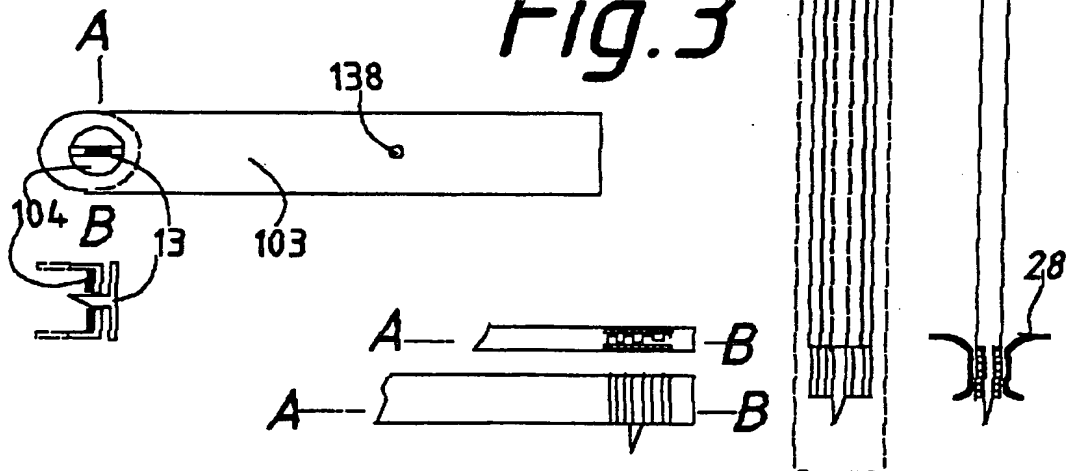
*Fig. 1*

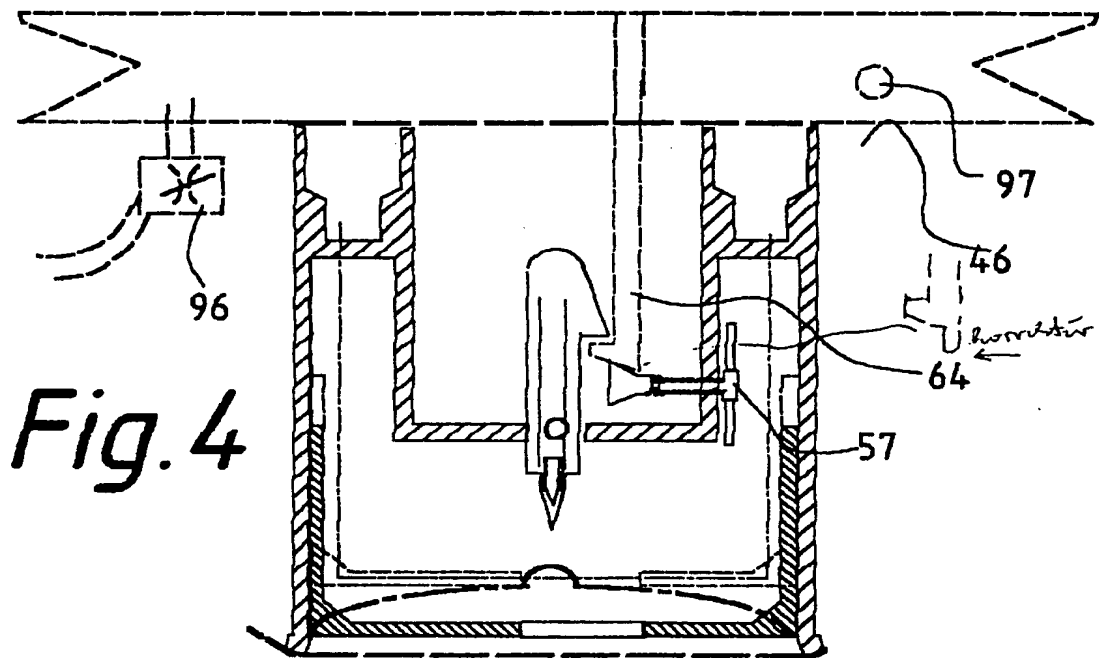


*Fig. 2*

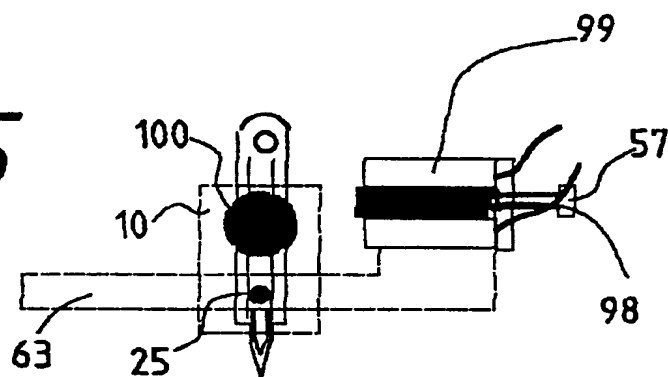


*Fig. 3*

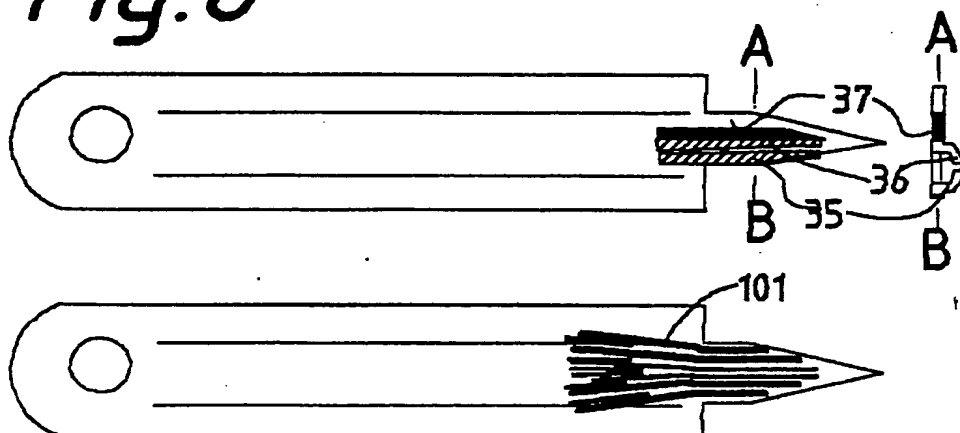


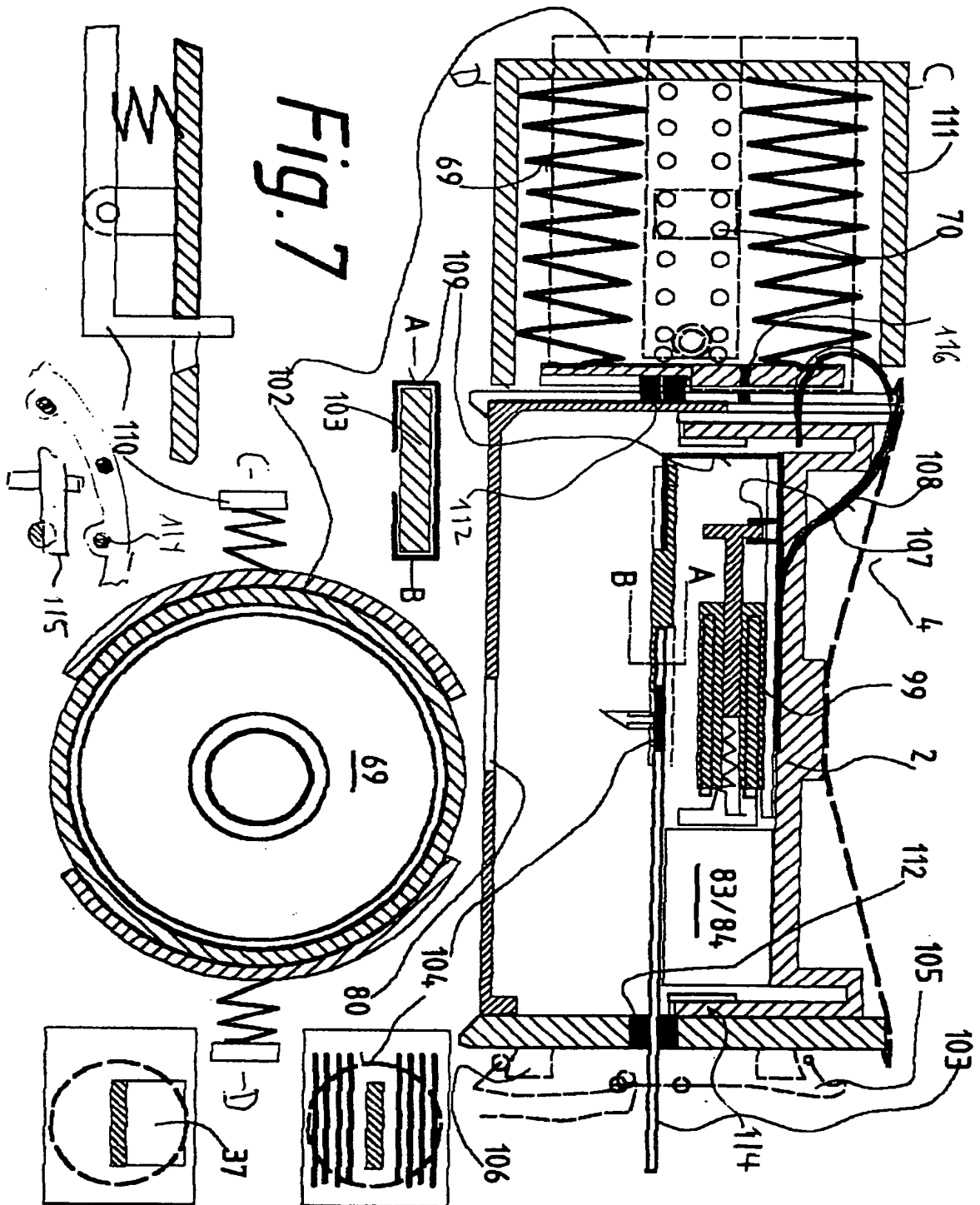


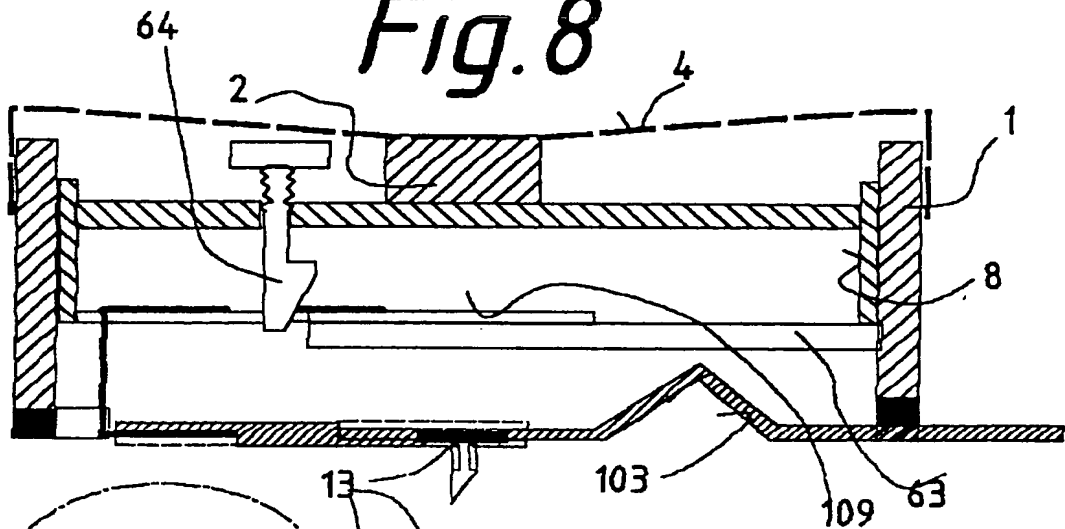
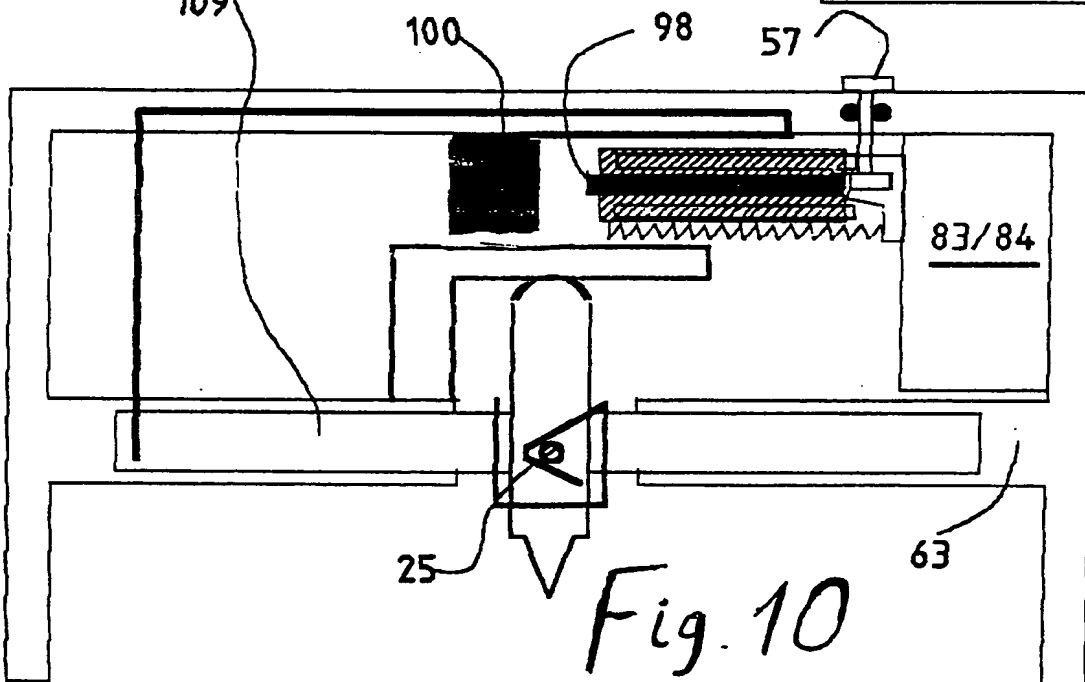
*Fig. 5*

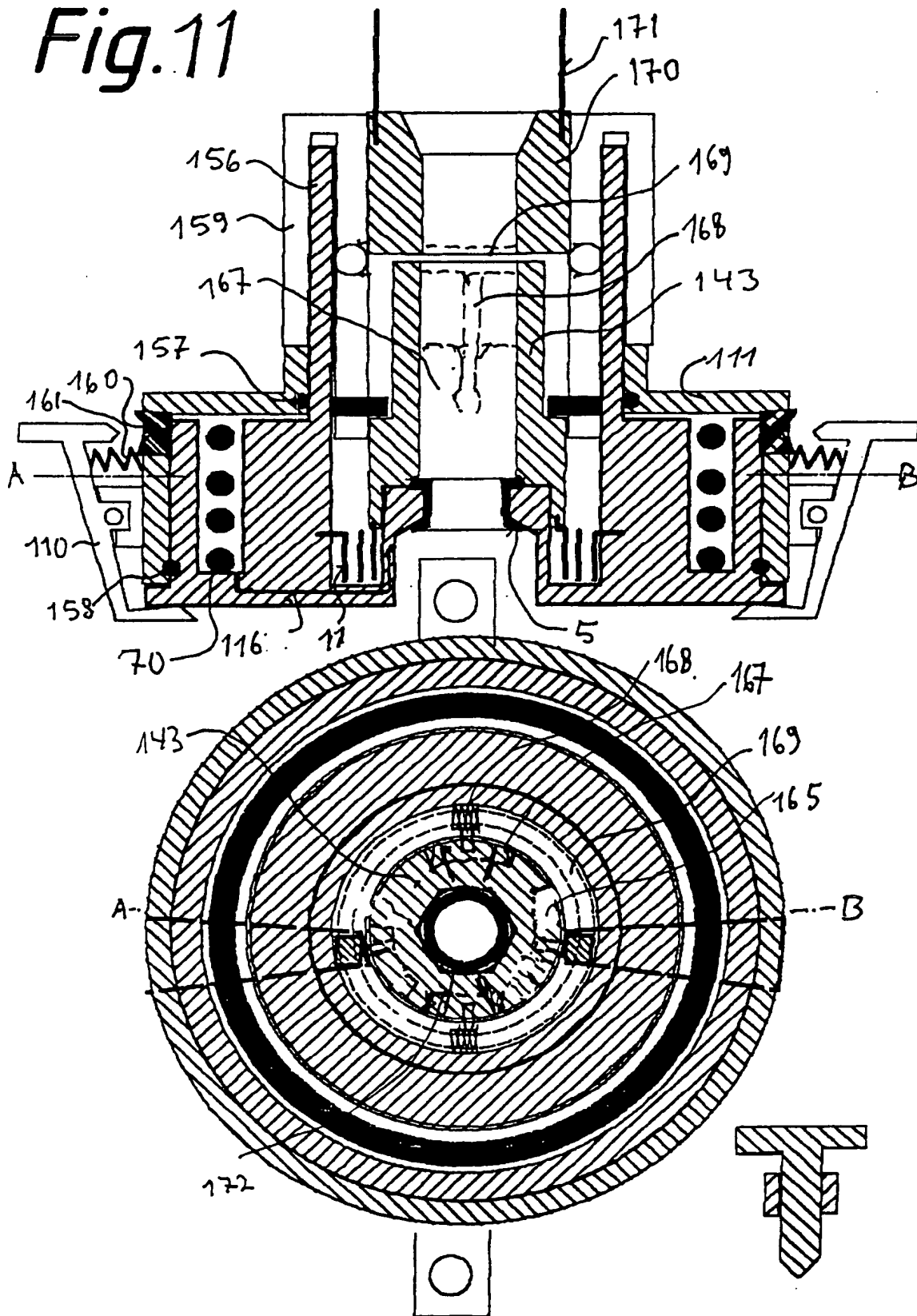


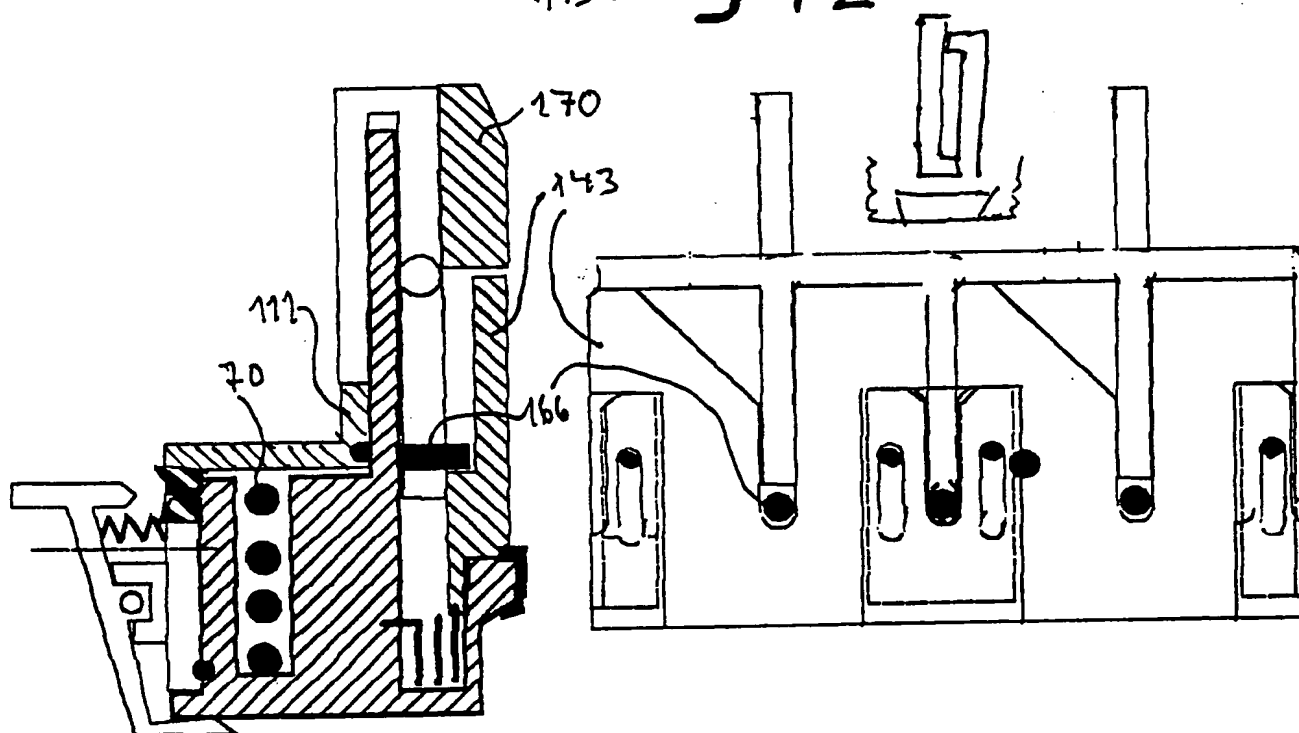
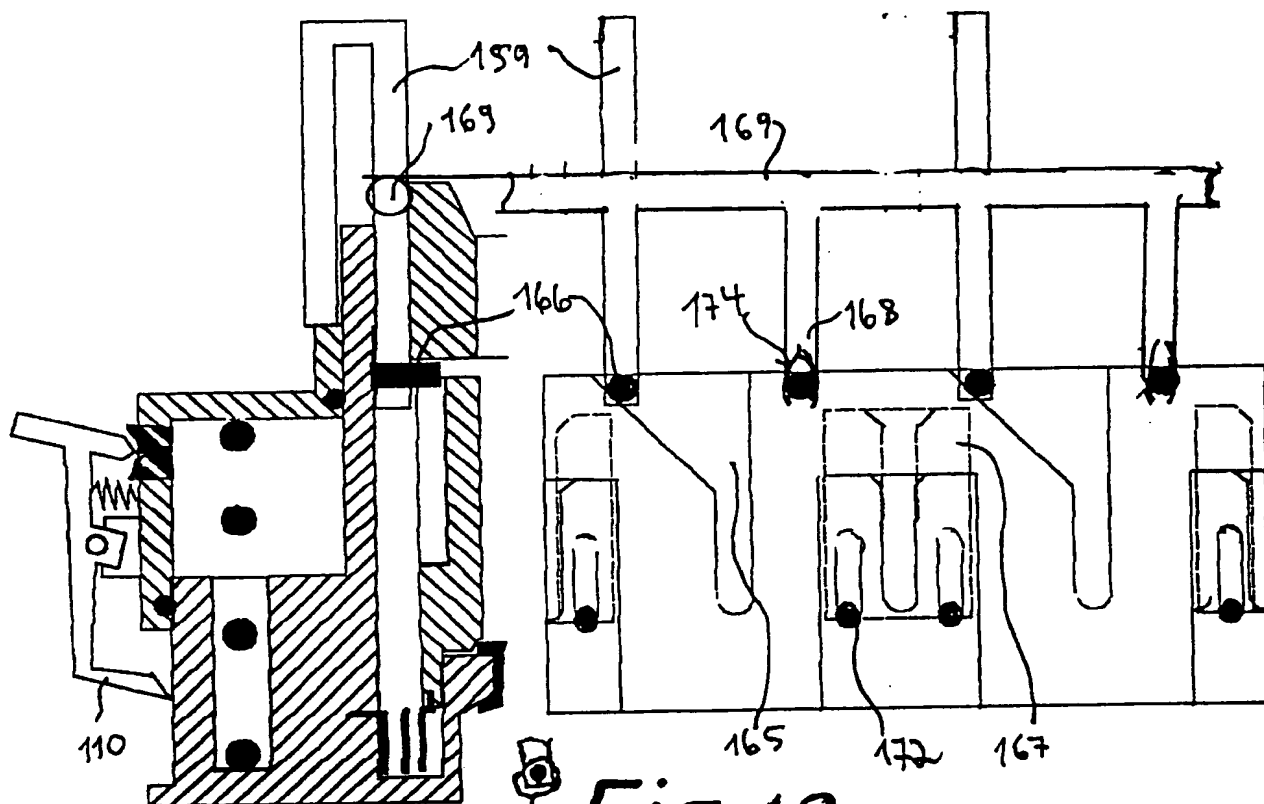
*Fig. 6*

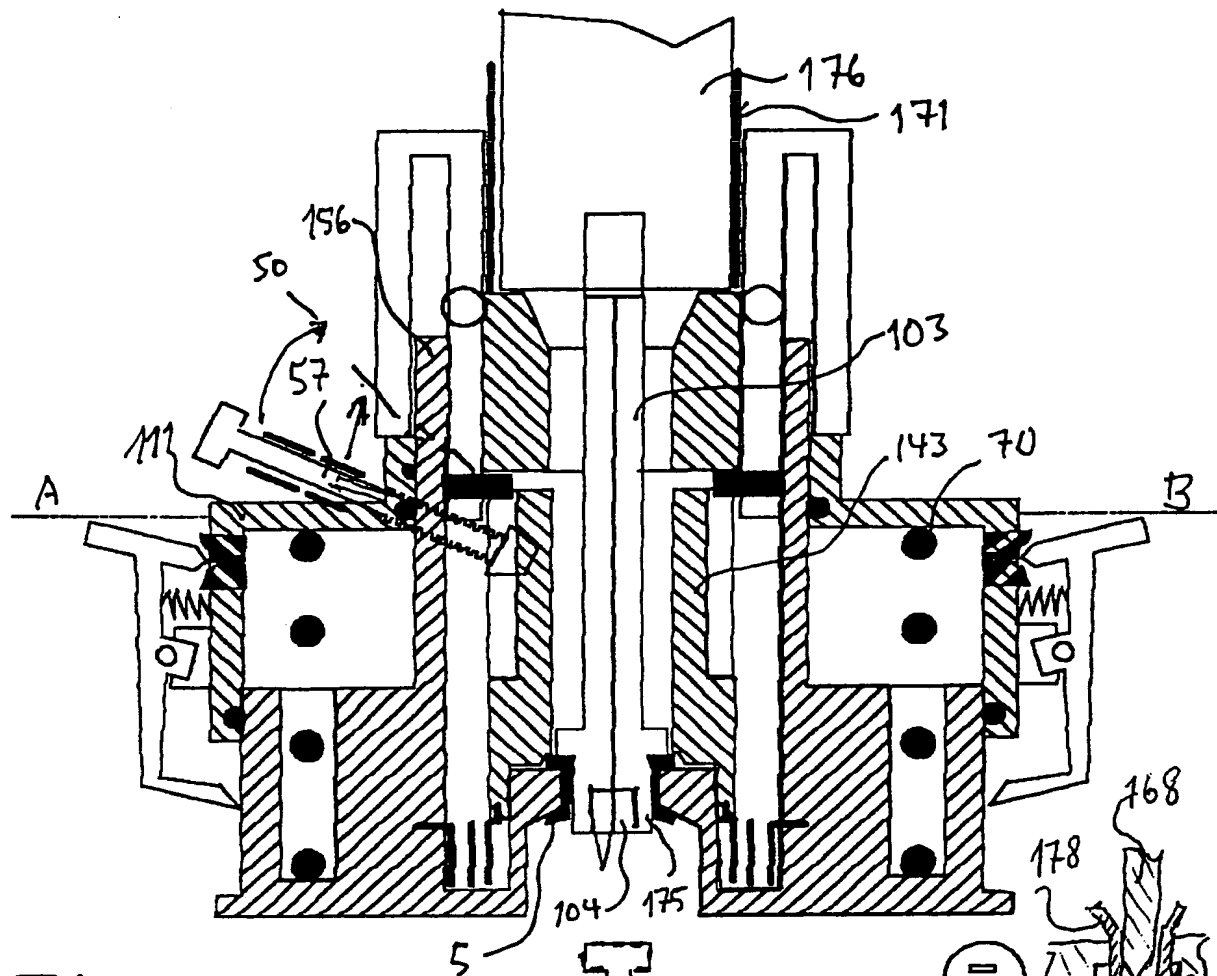




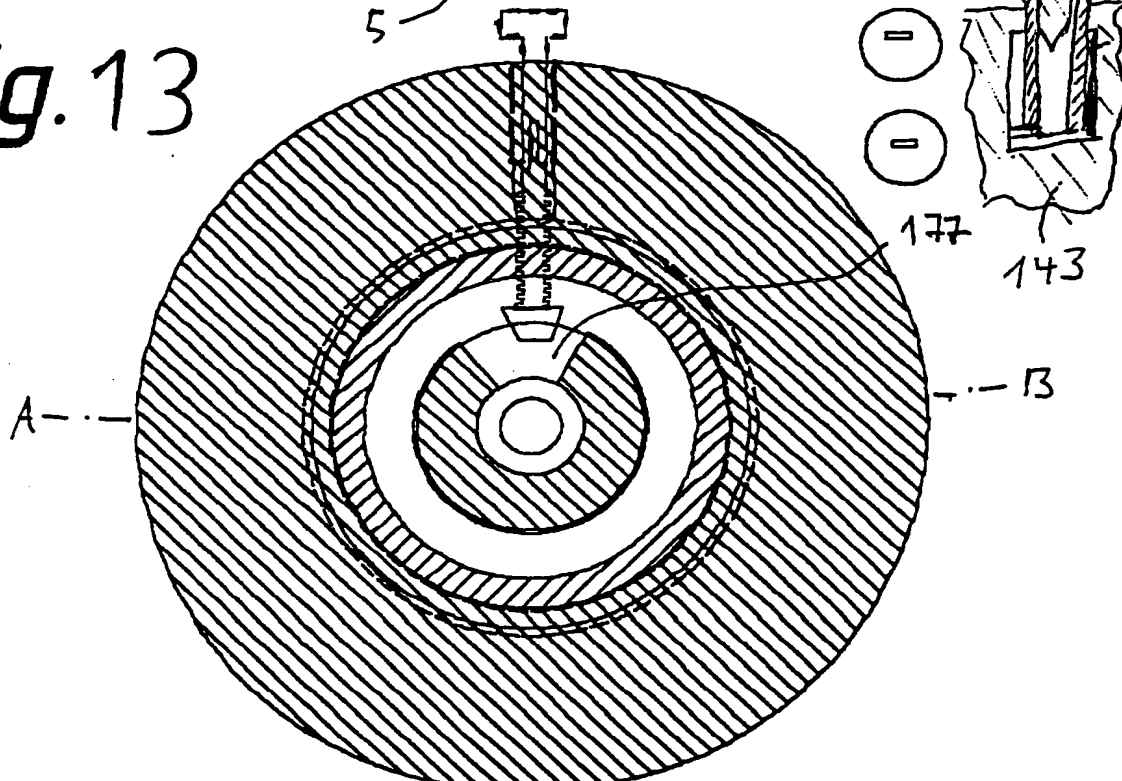
*Fig. 8**Fig. 9**Fig. 10*

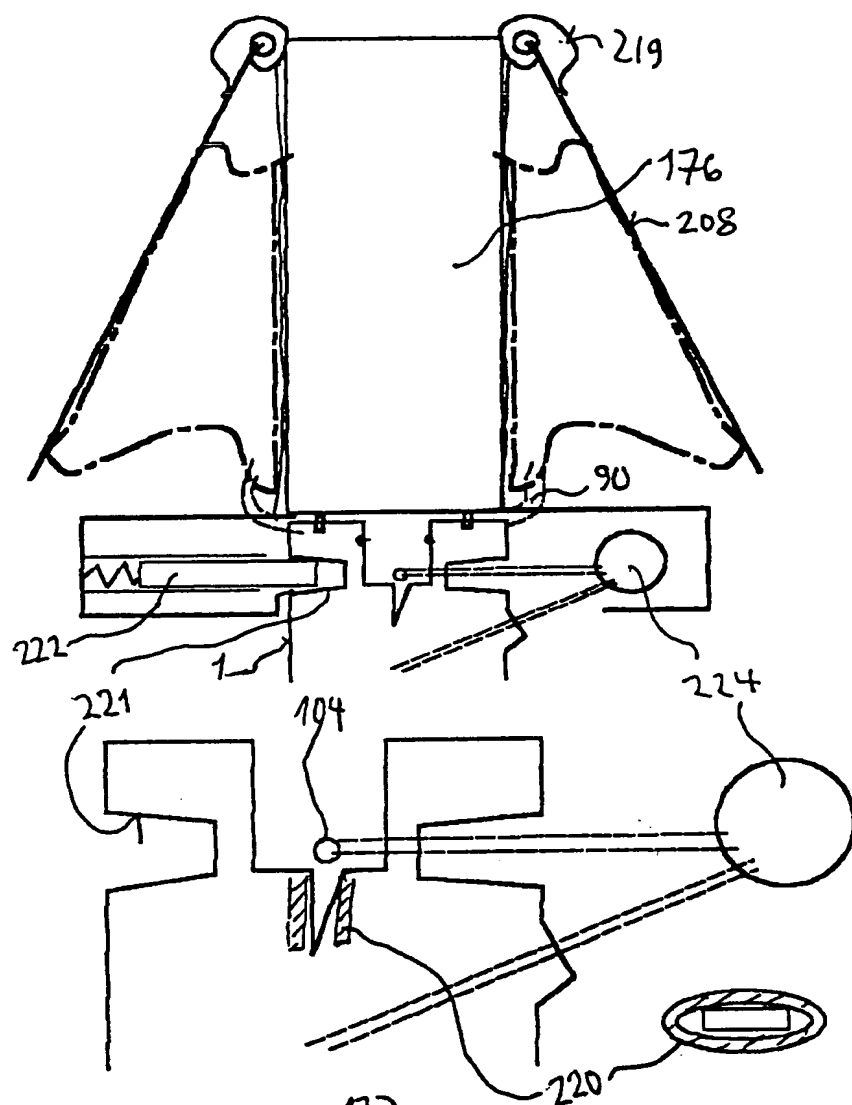
*Fig. 11*



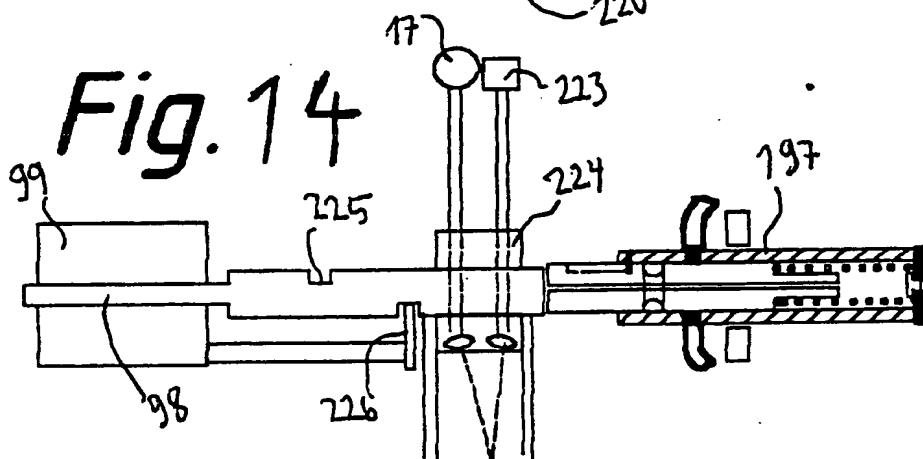


**Fig. 13**

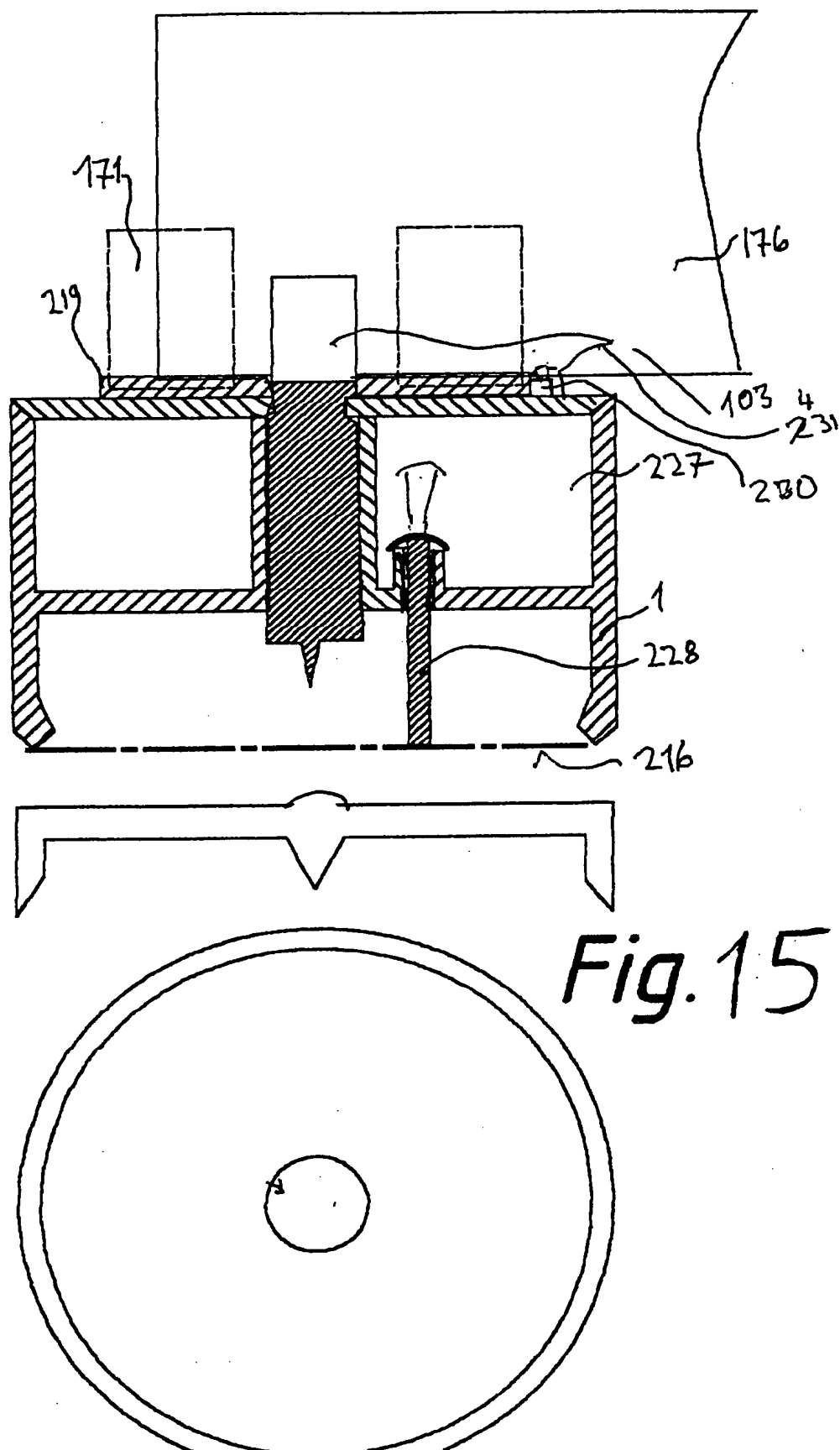


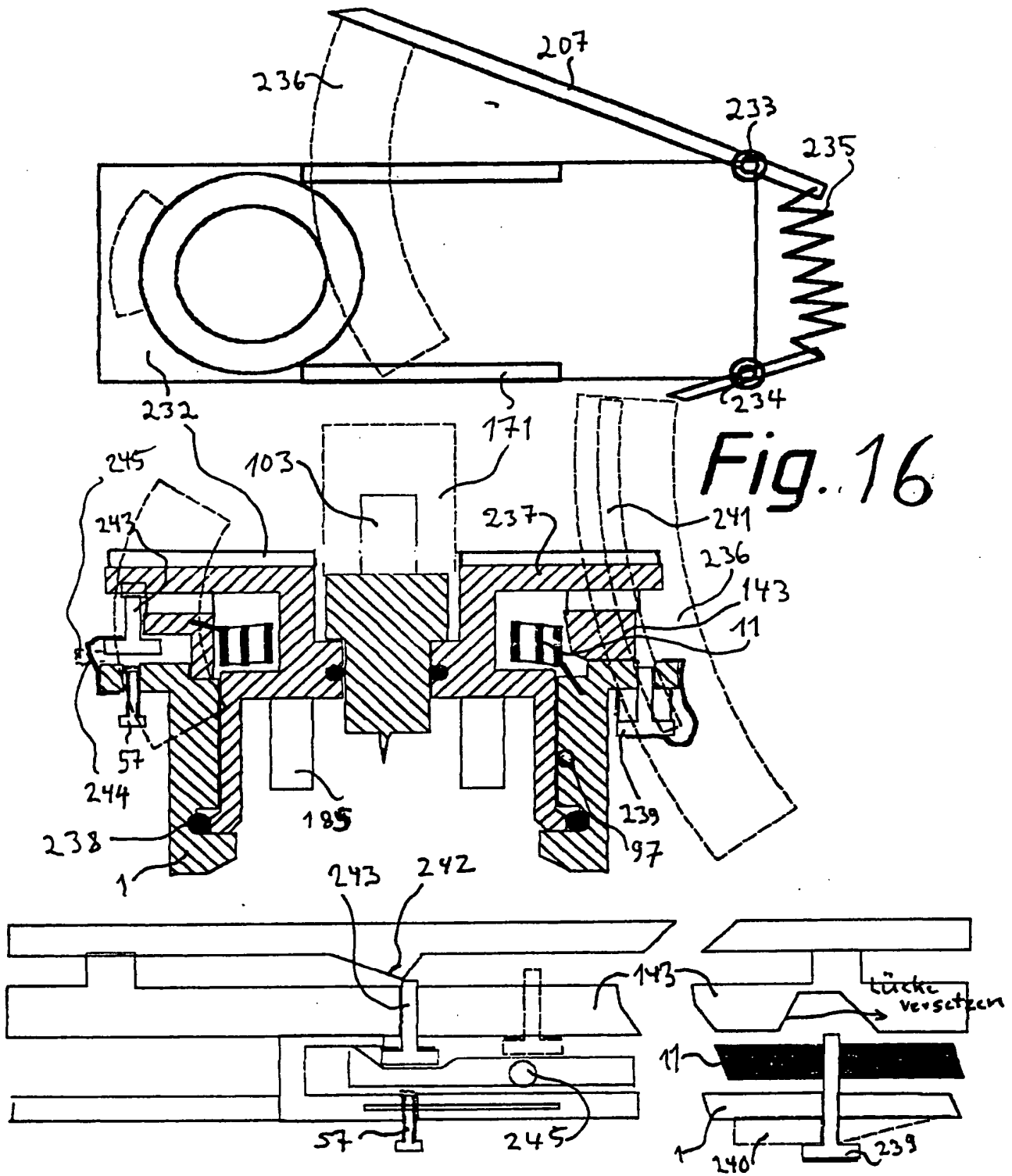


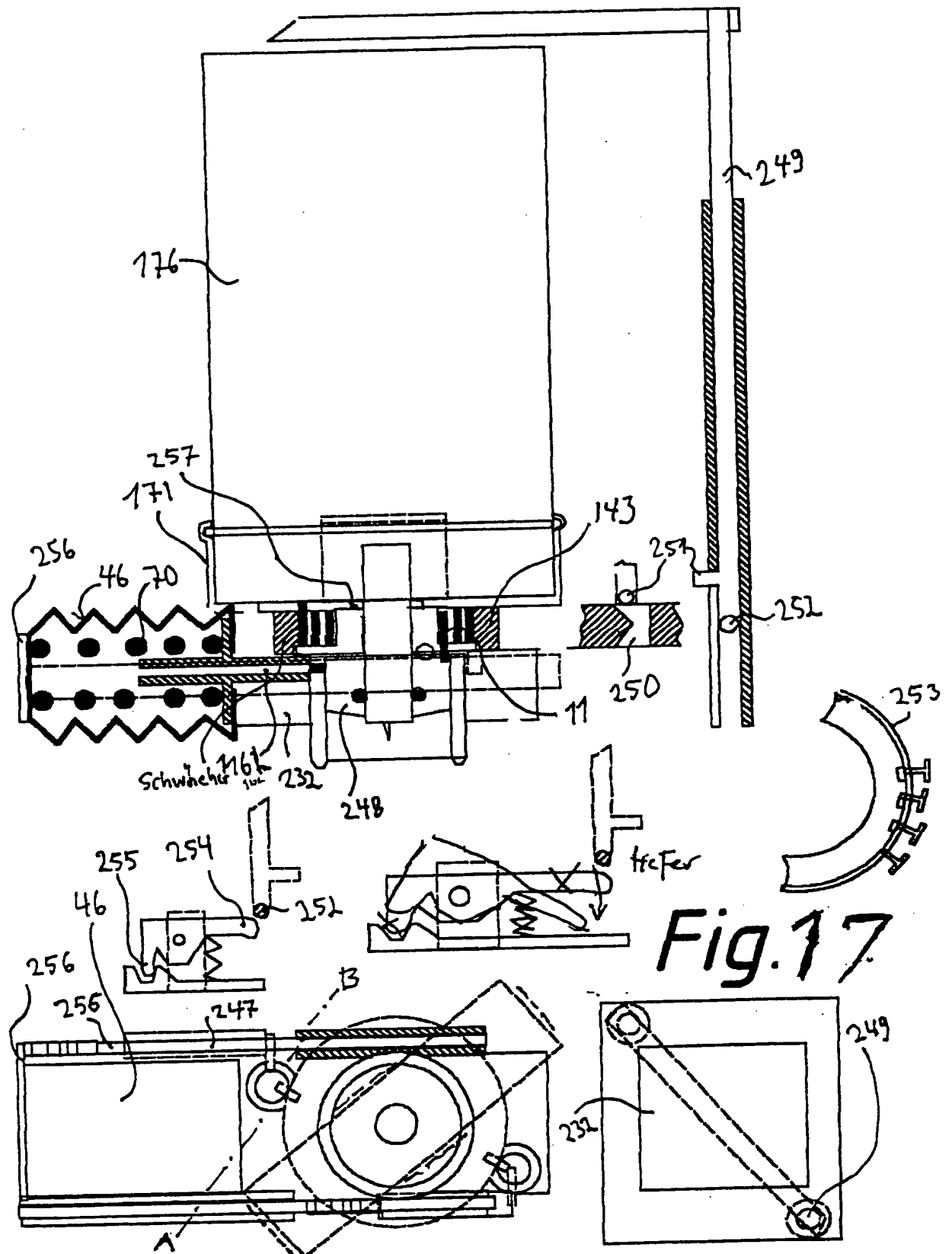
*Fig. 14*

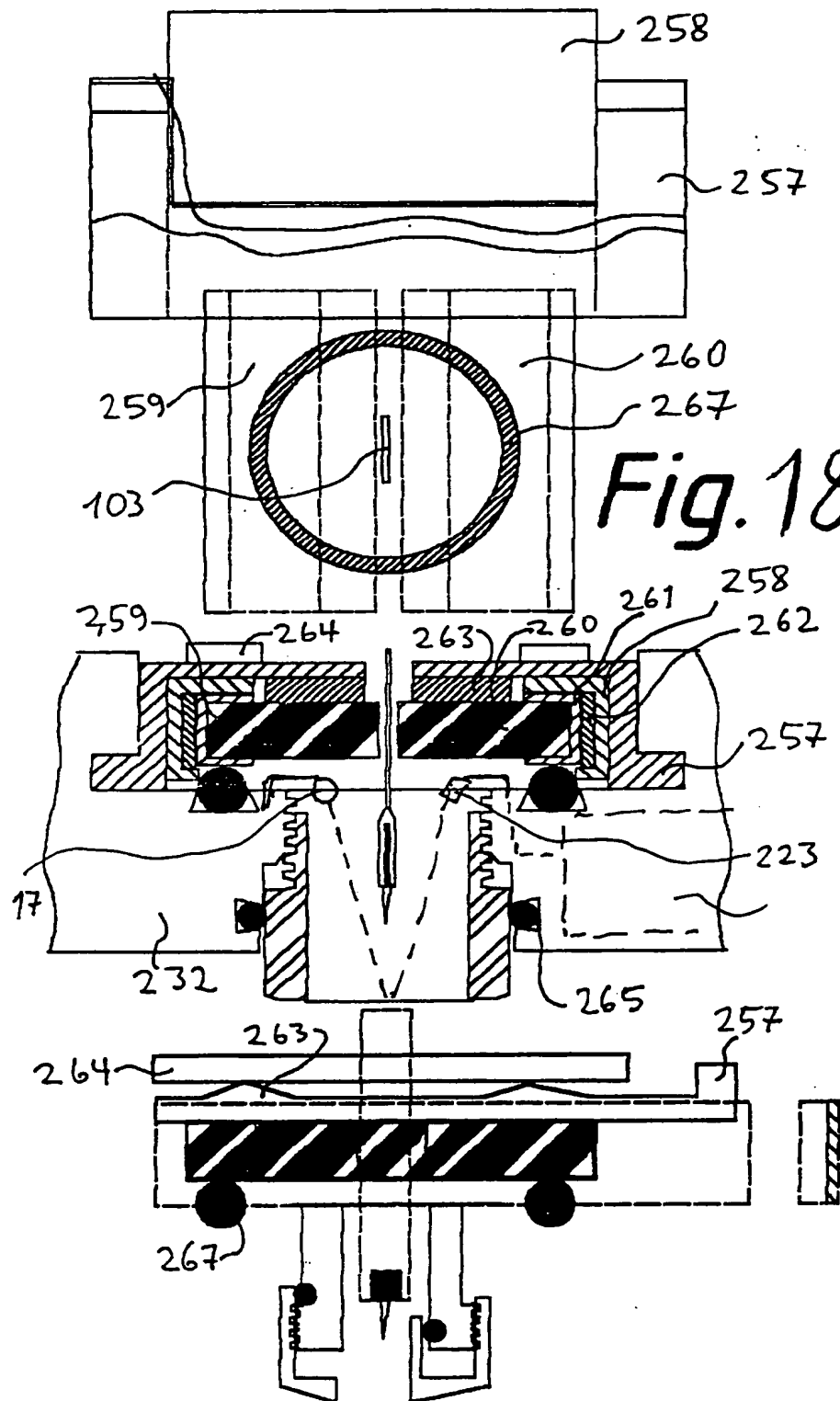




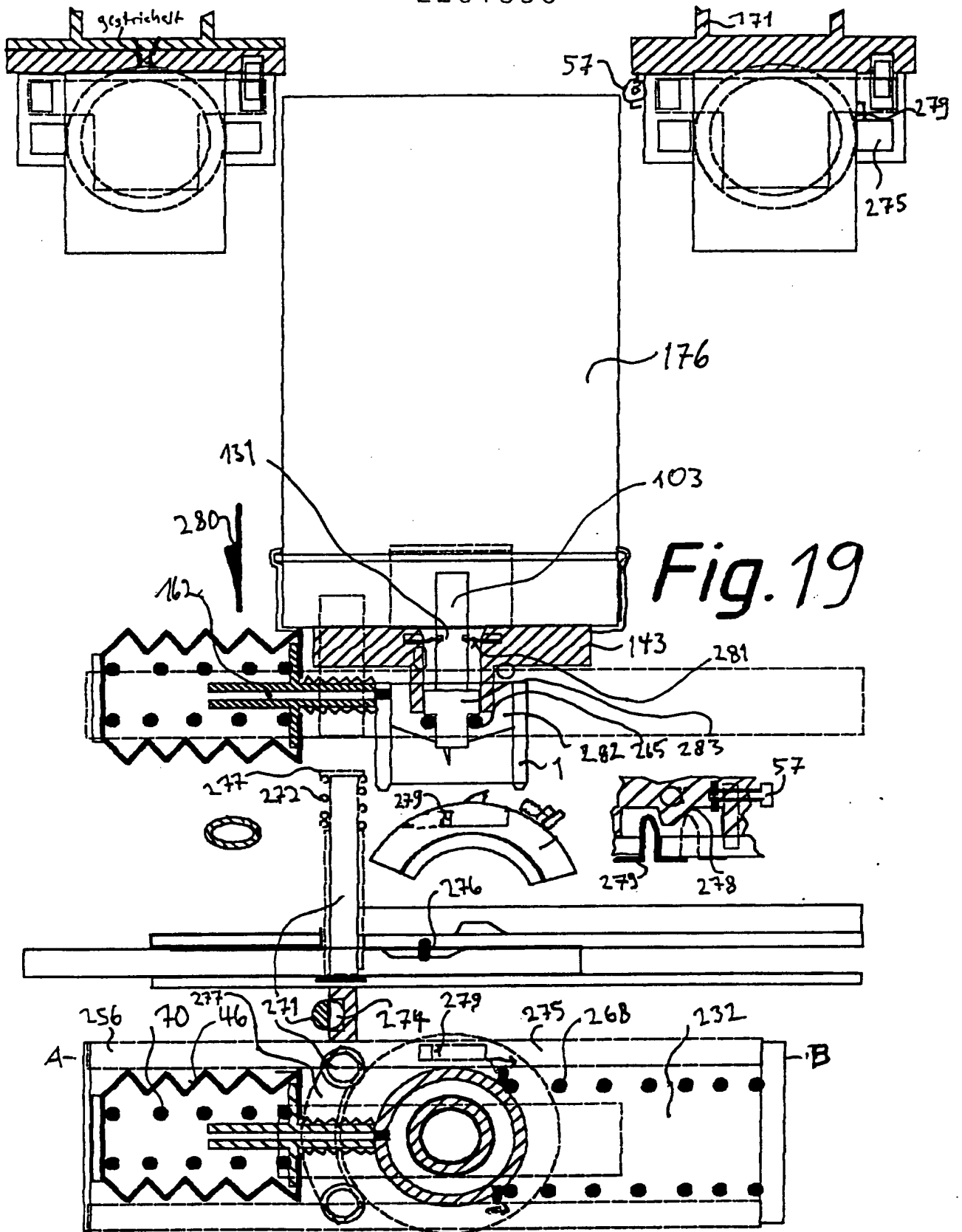








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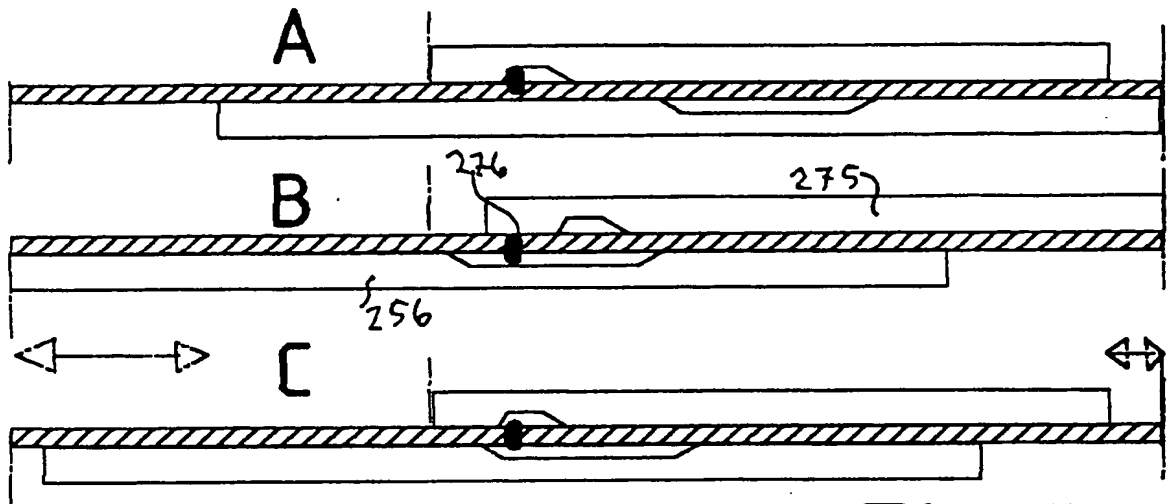


Fig. 20

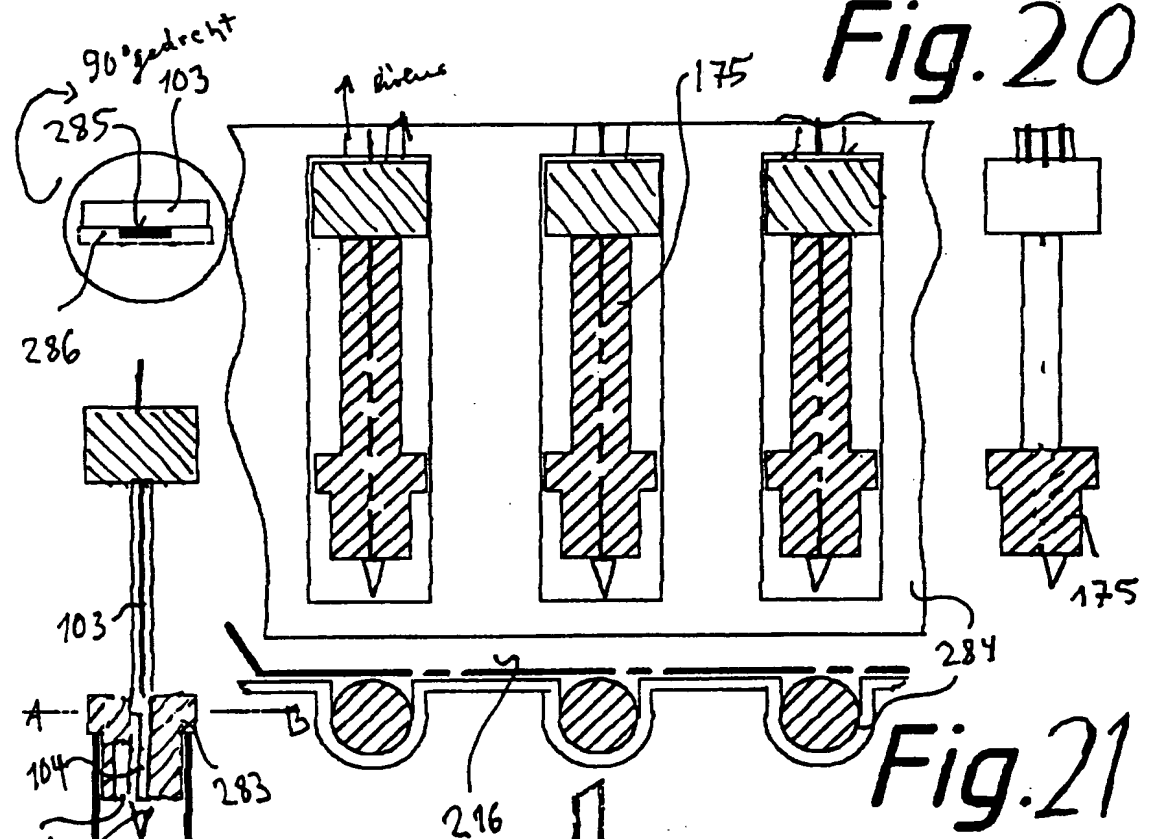


Fig. 21

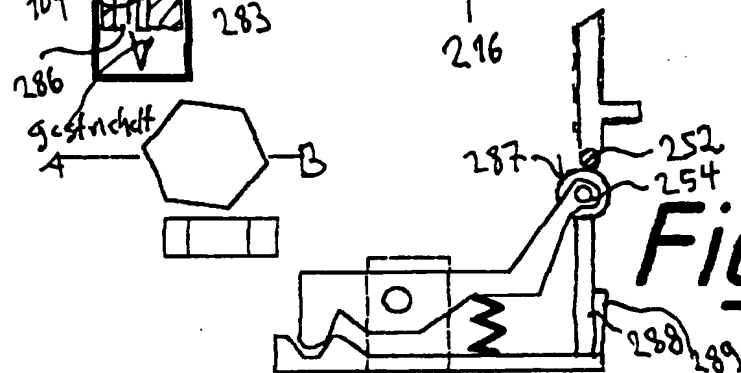
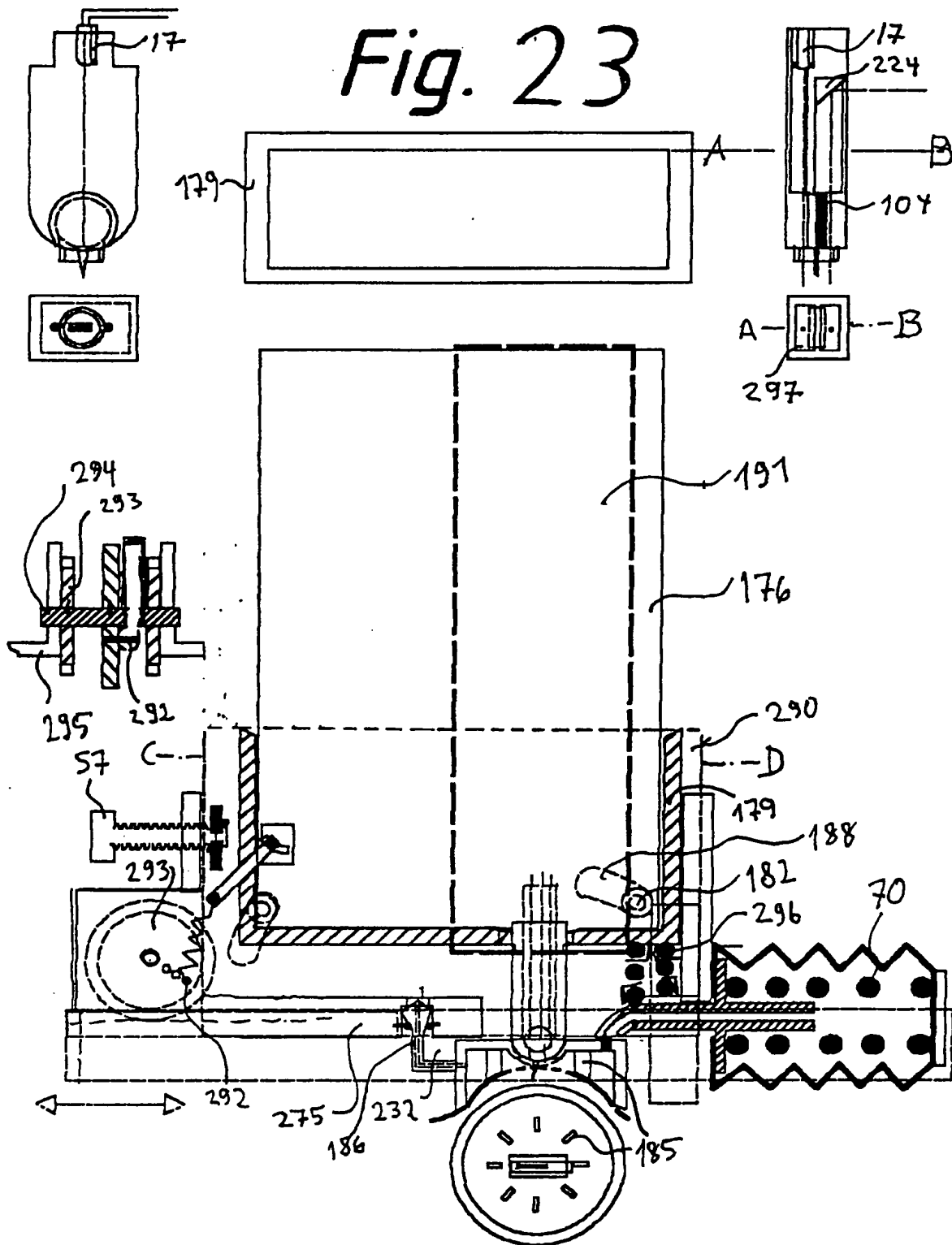
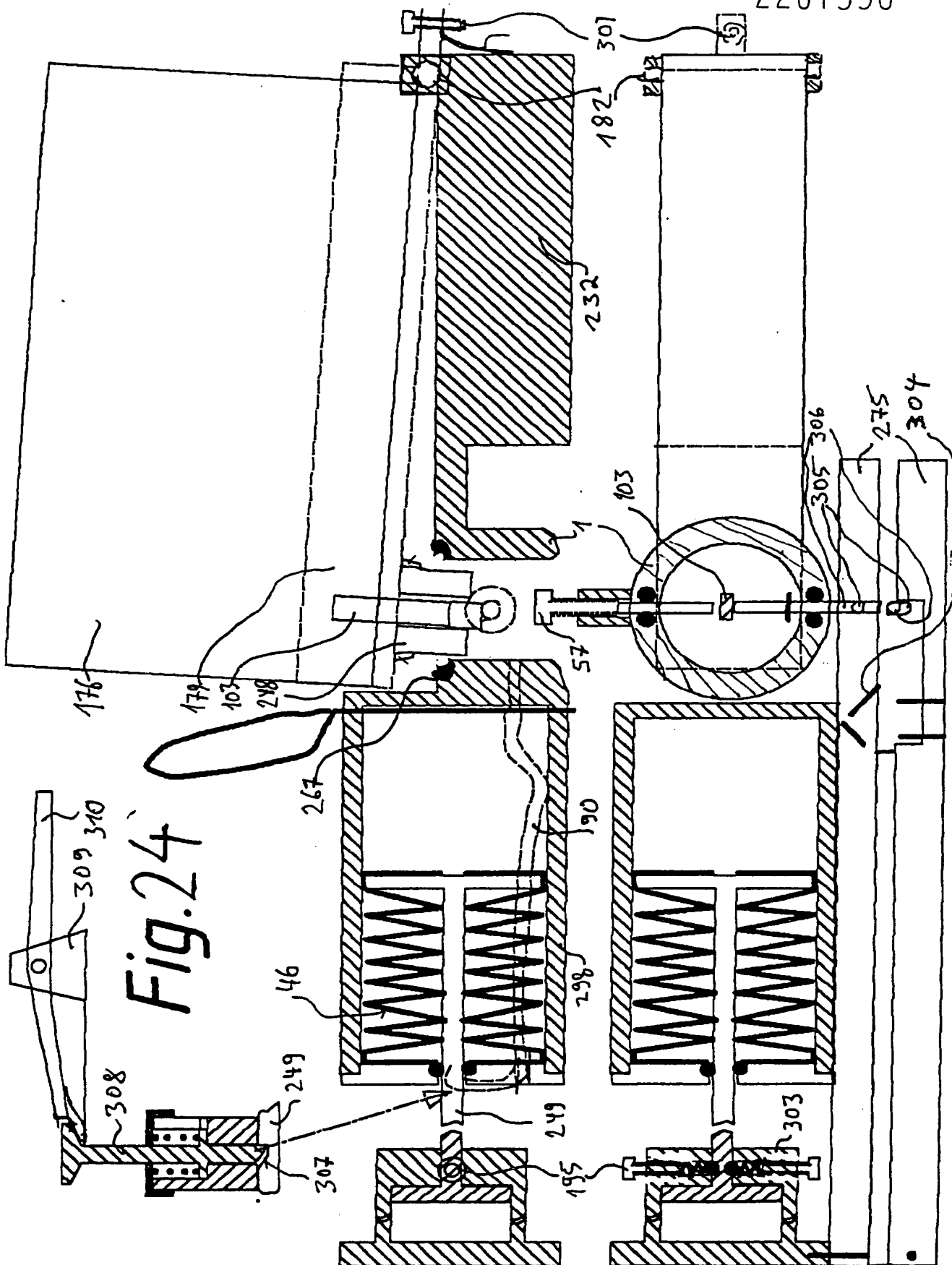


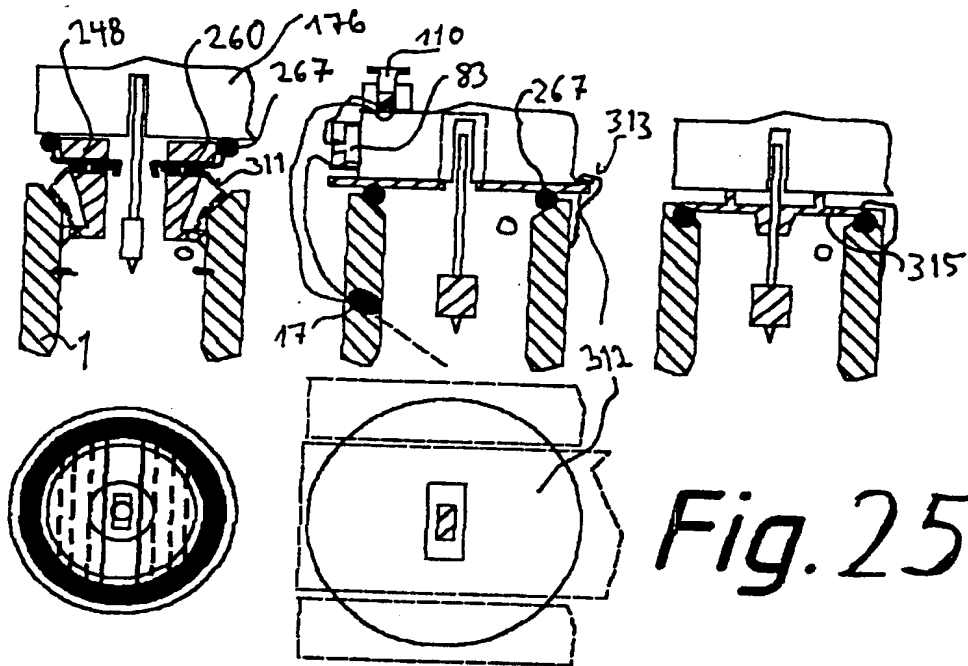
Fig. 22

*Fig. 23*

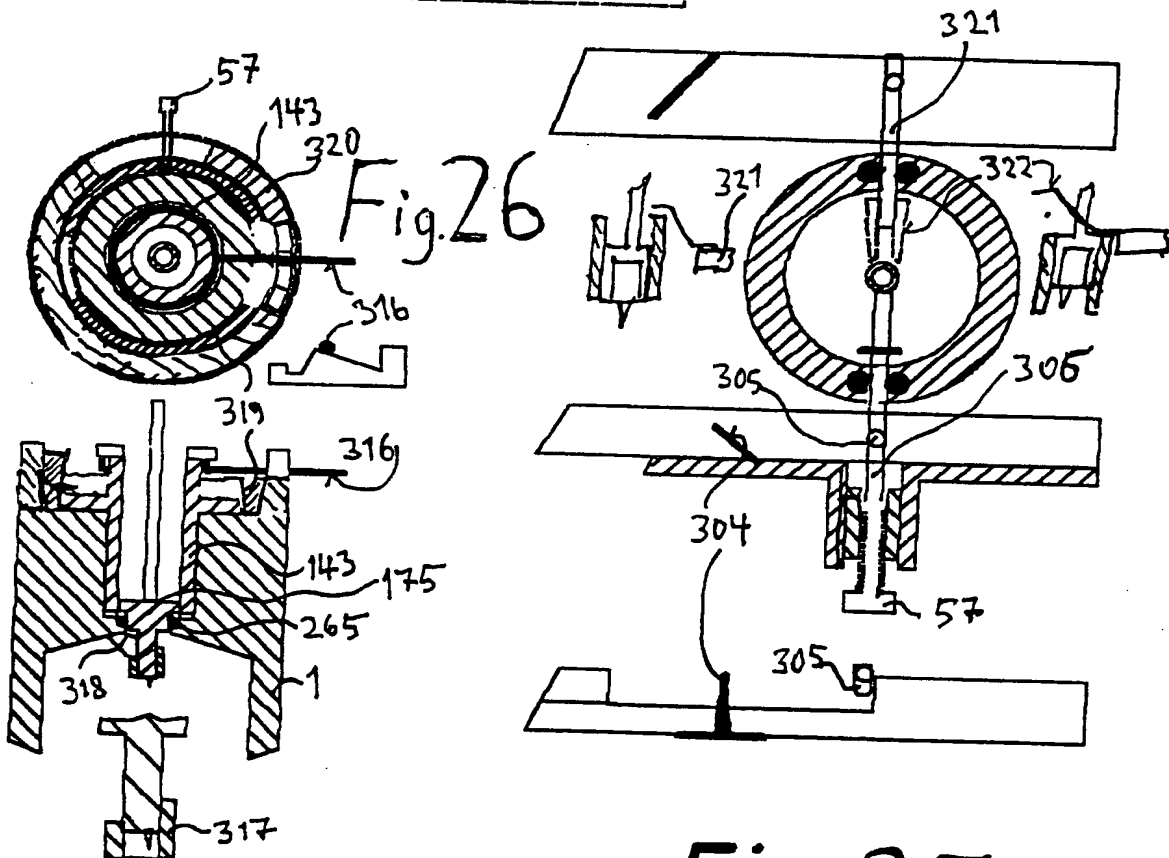








*Fig. 25*



*Fig. 27*

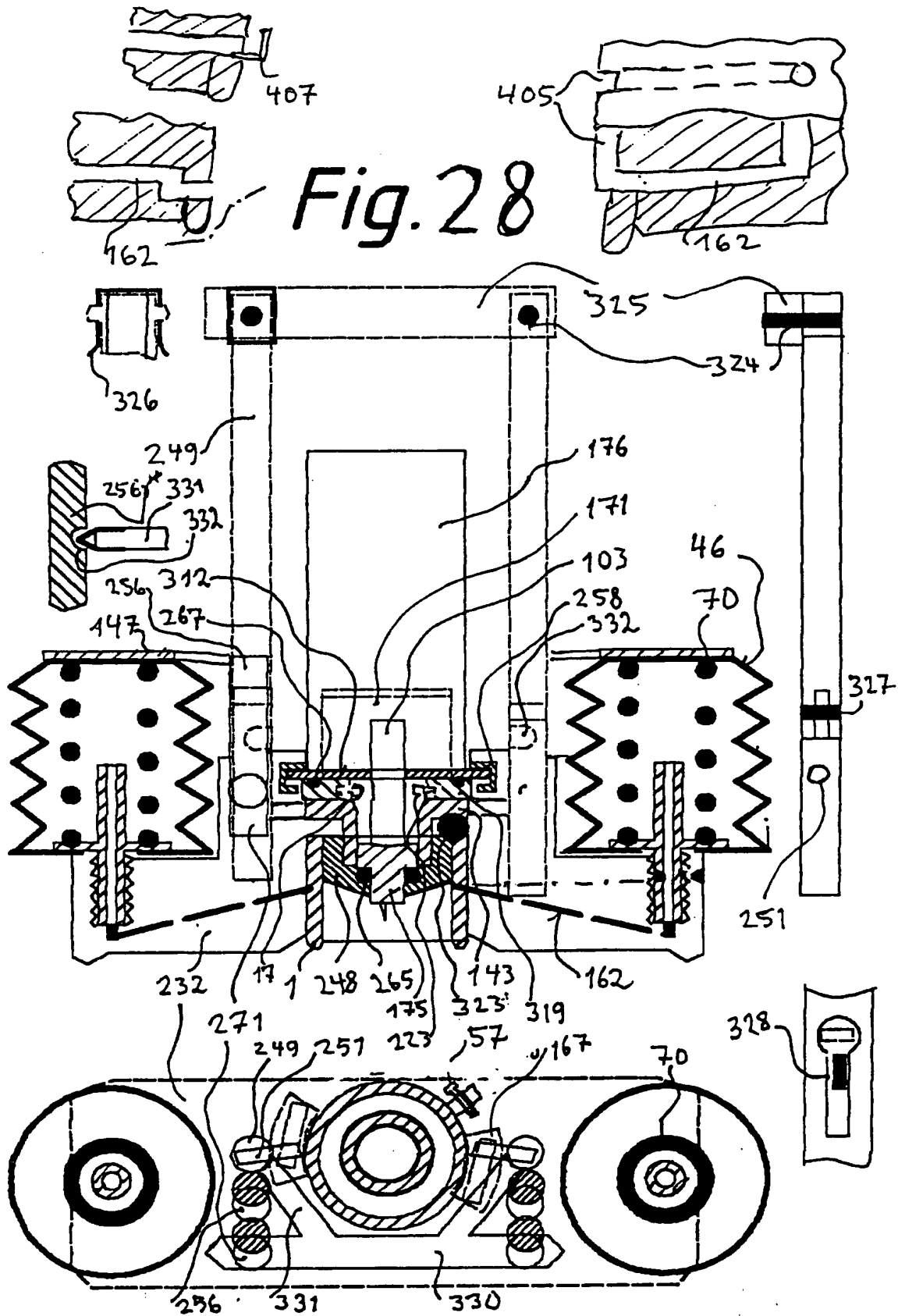


Fig. 29

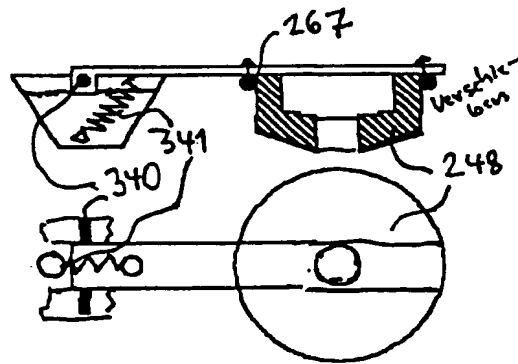
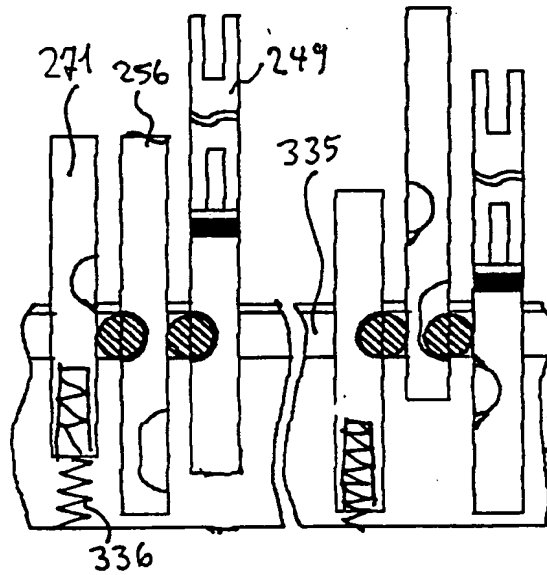


Fig. 30

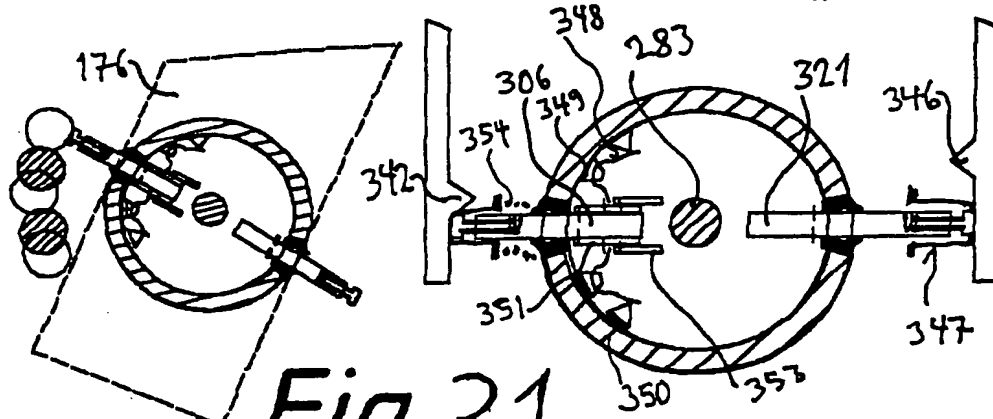
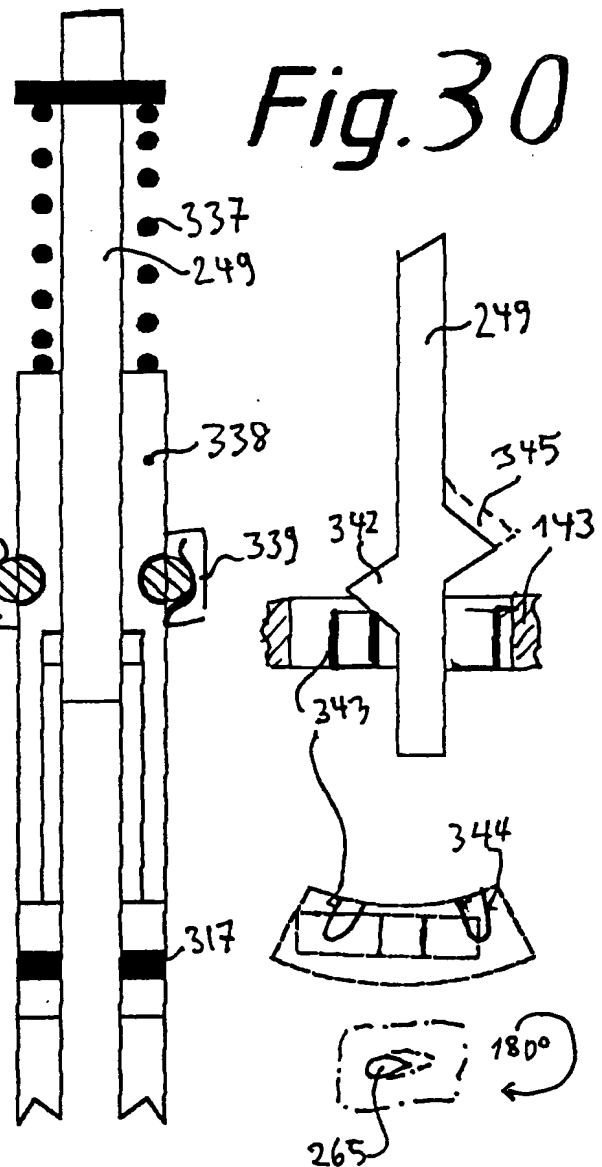
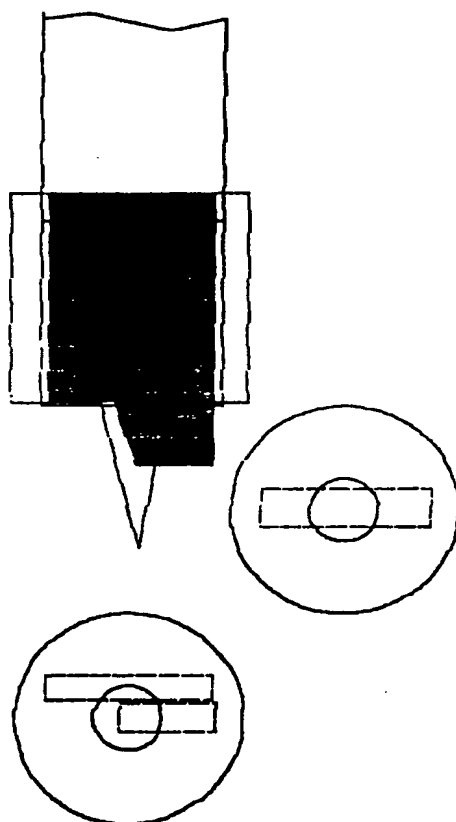
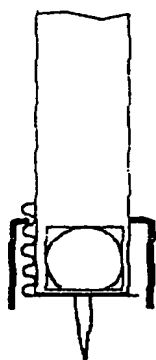
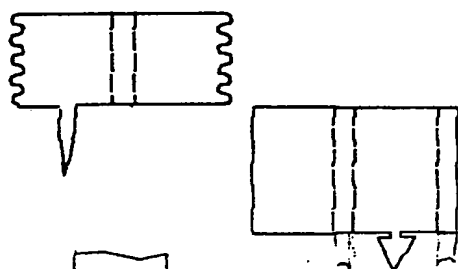
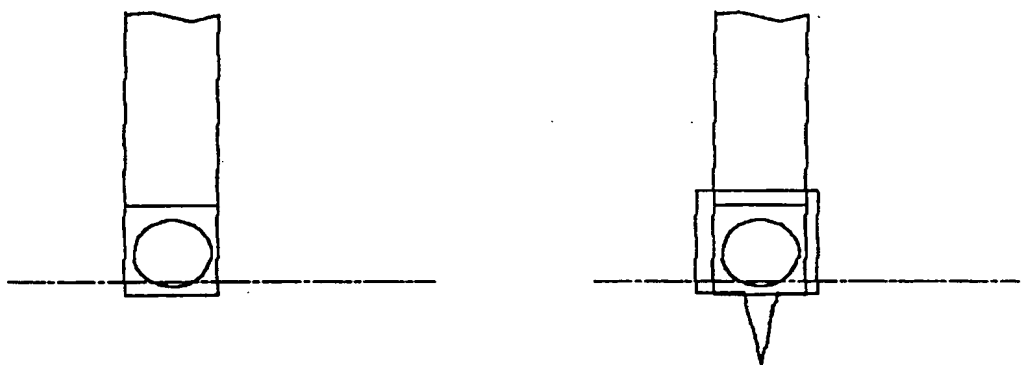


Fig. 31

*Fig. 32*



*Fig. 33*

Fig. 34

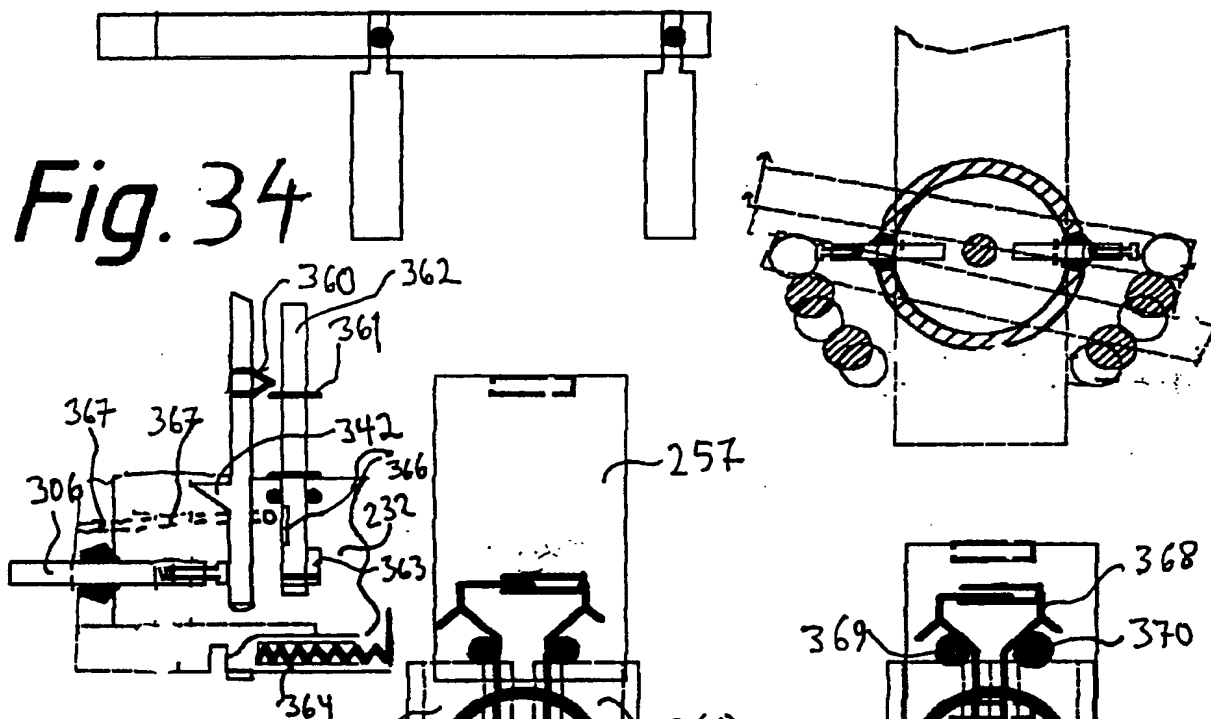


Fig. 36

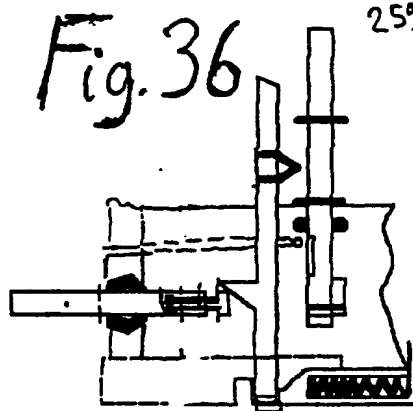
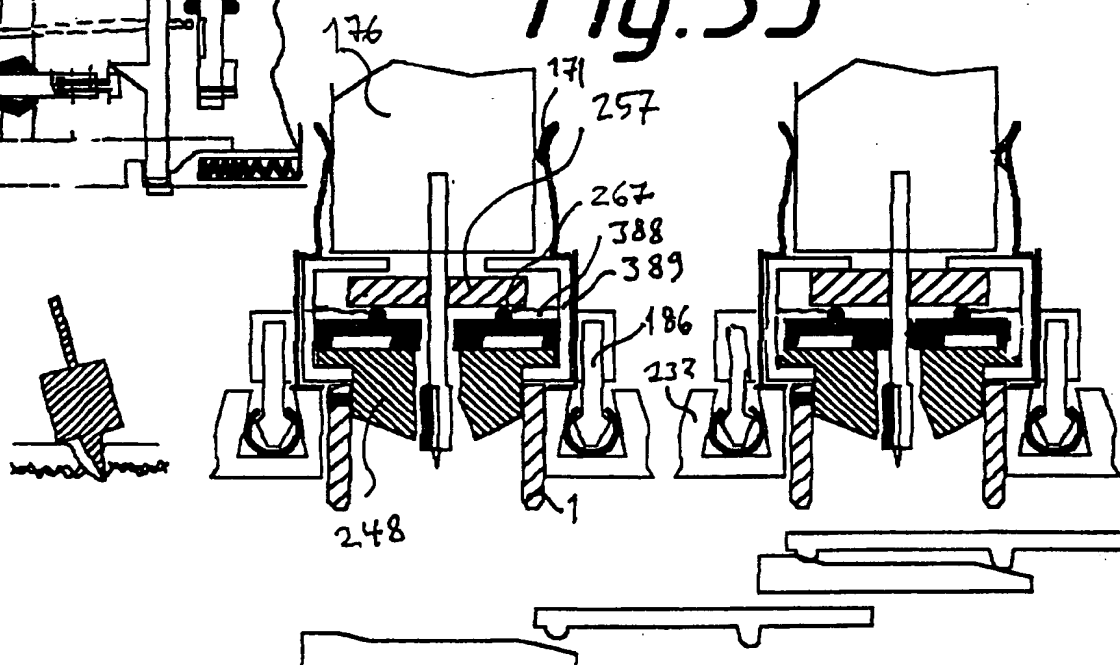
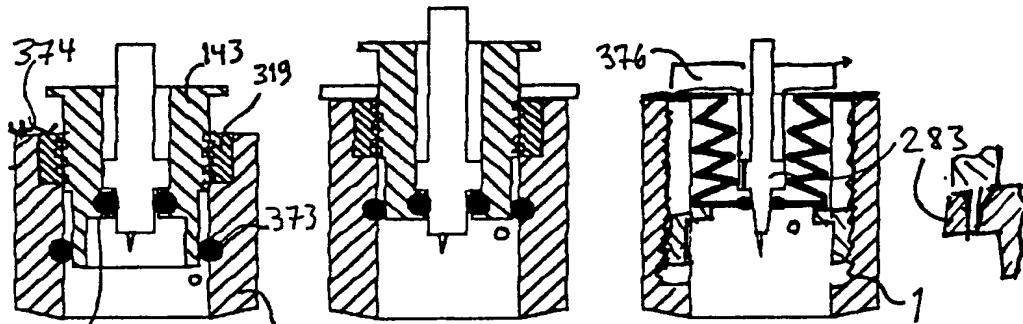
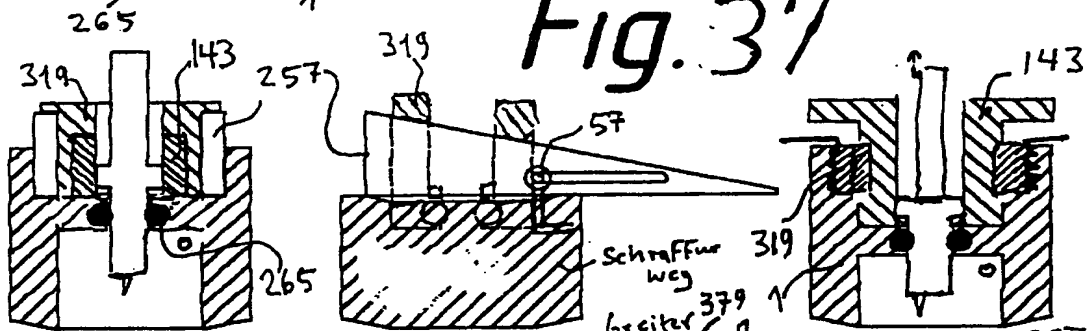


Fig. 35

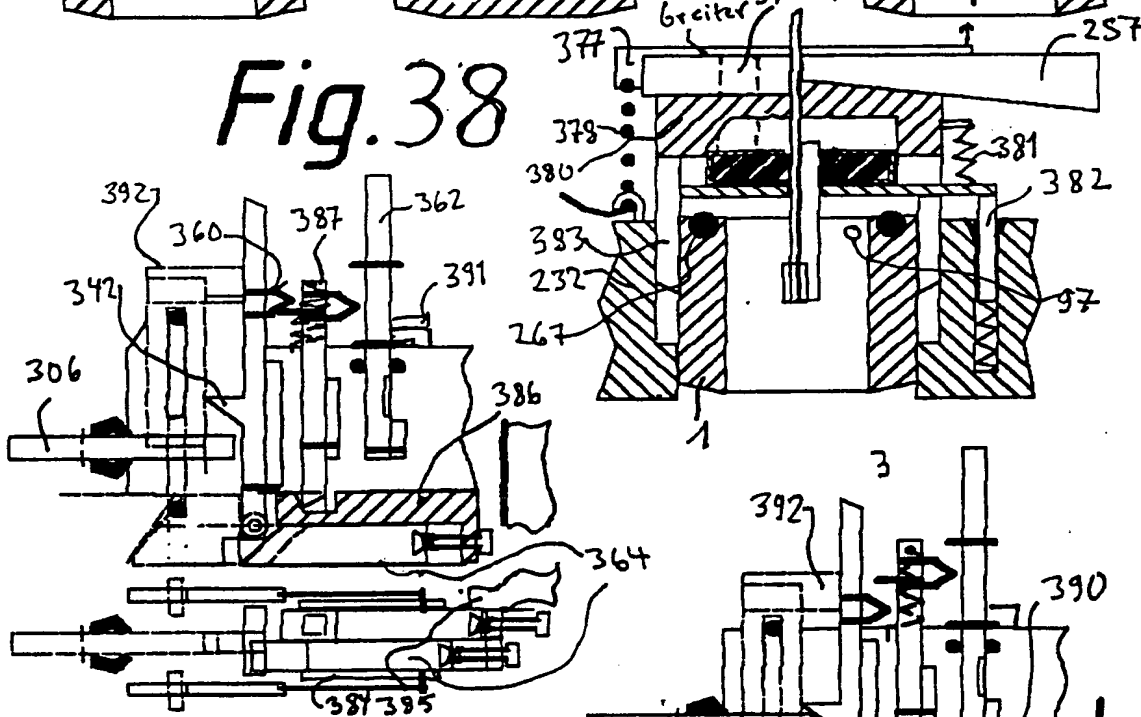




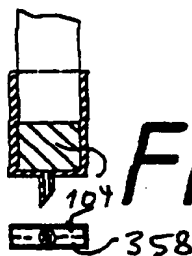
*Fig. 37*



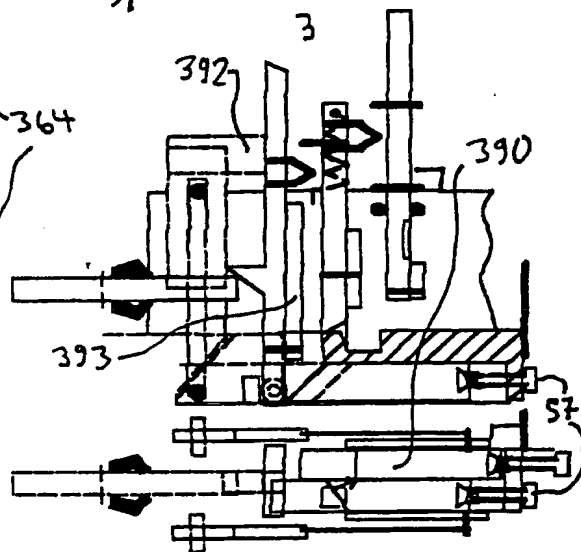
*Fig. 38*

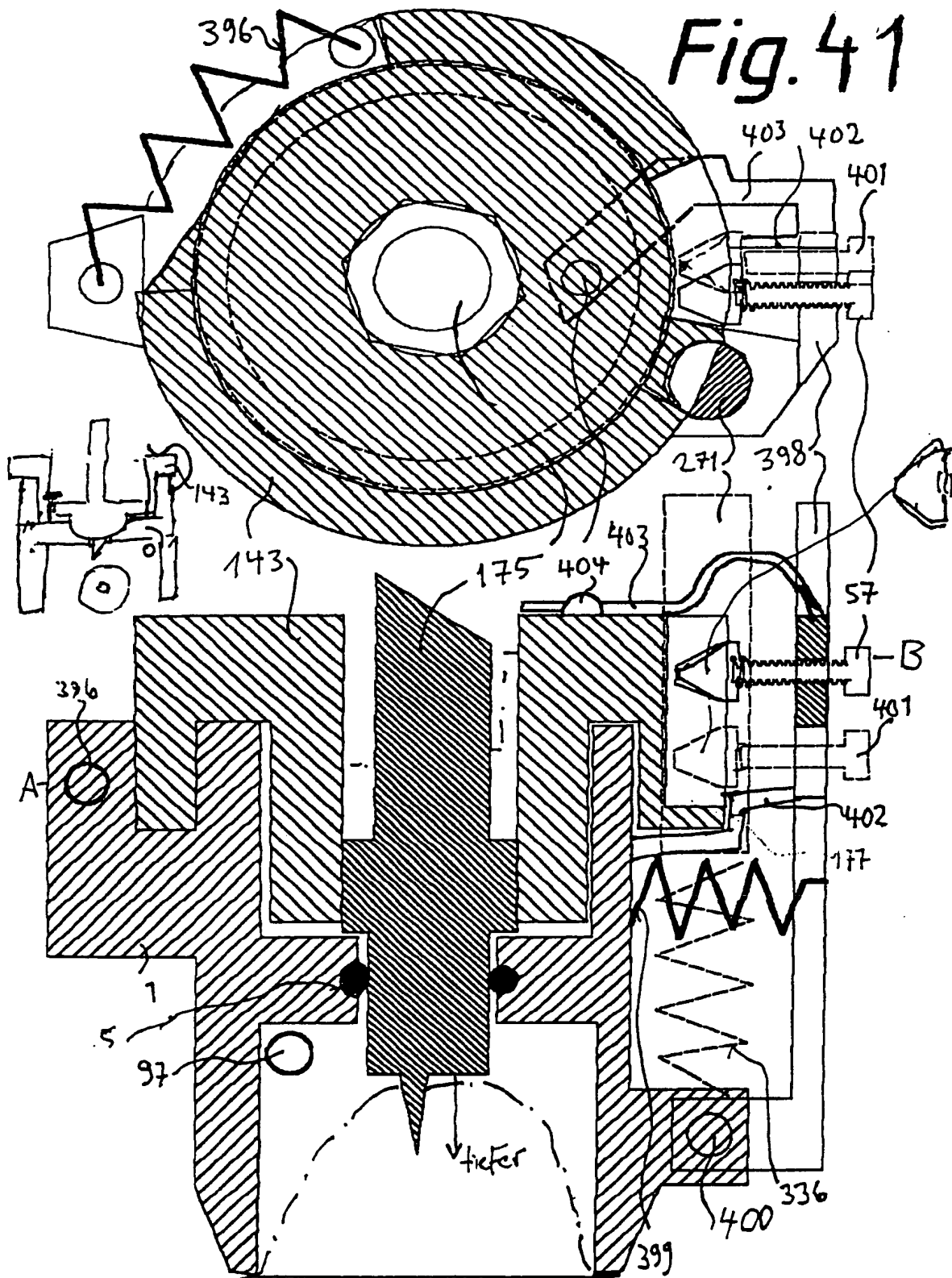


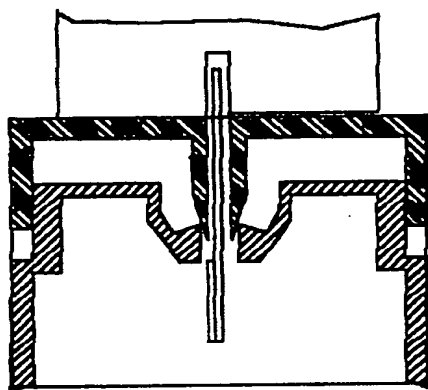
*Fig. 39*



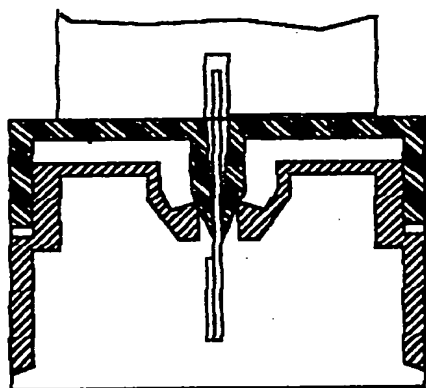
*Fig. 40*



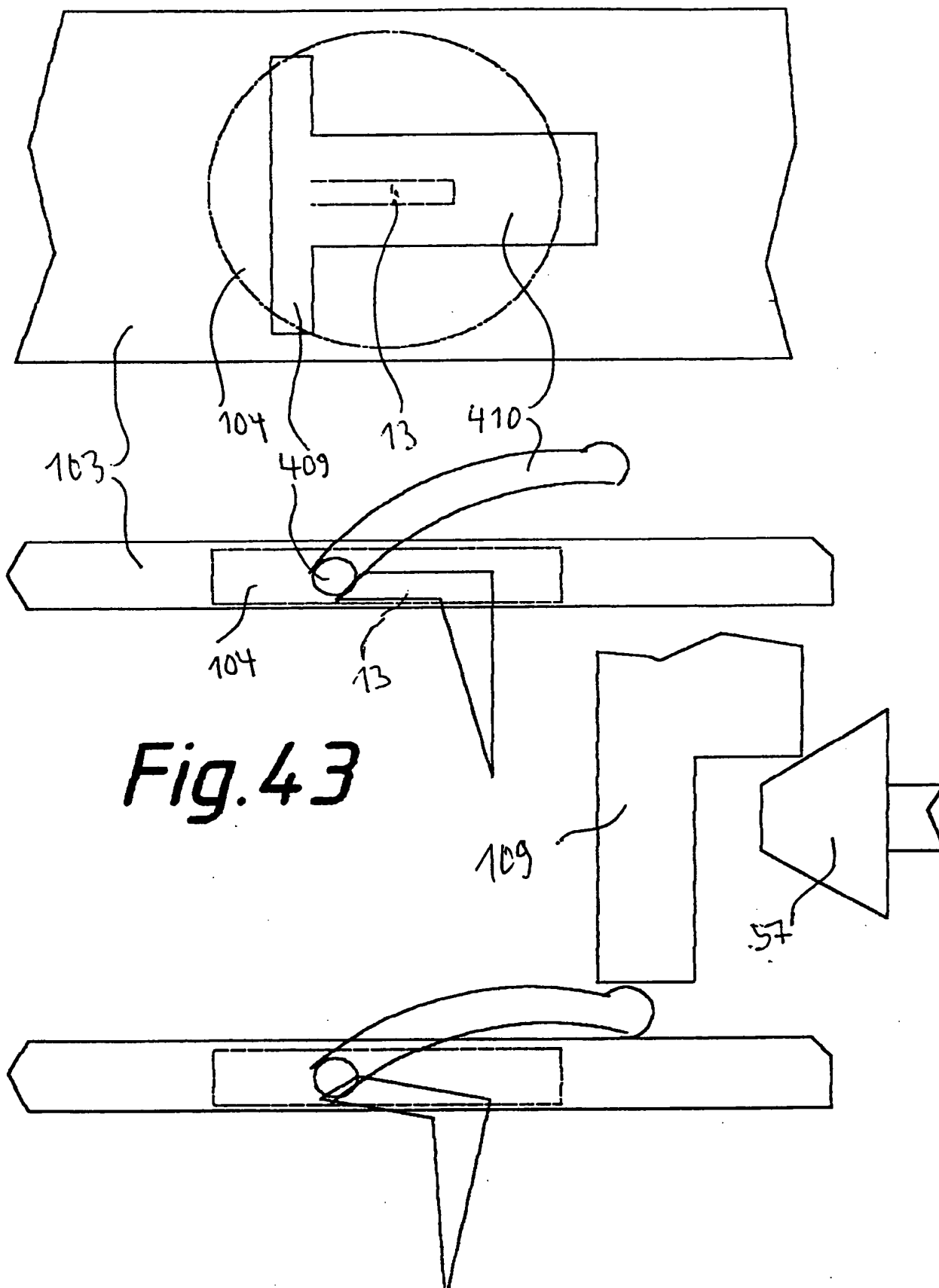
*Fig. 41*

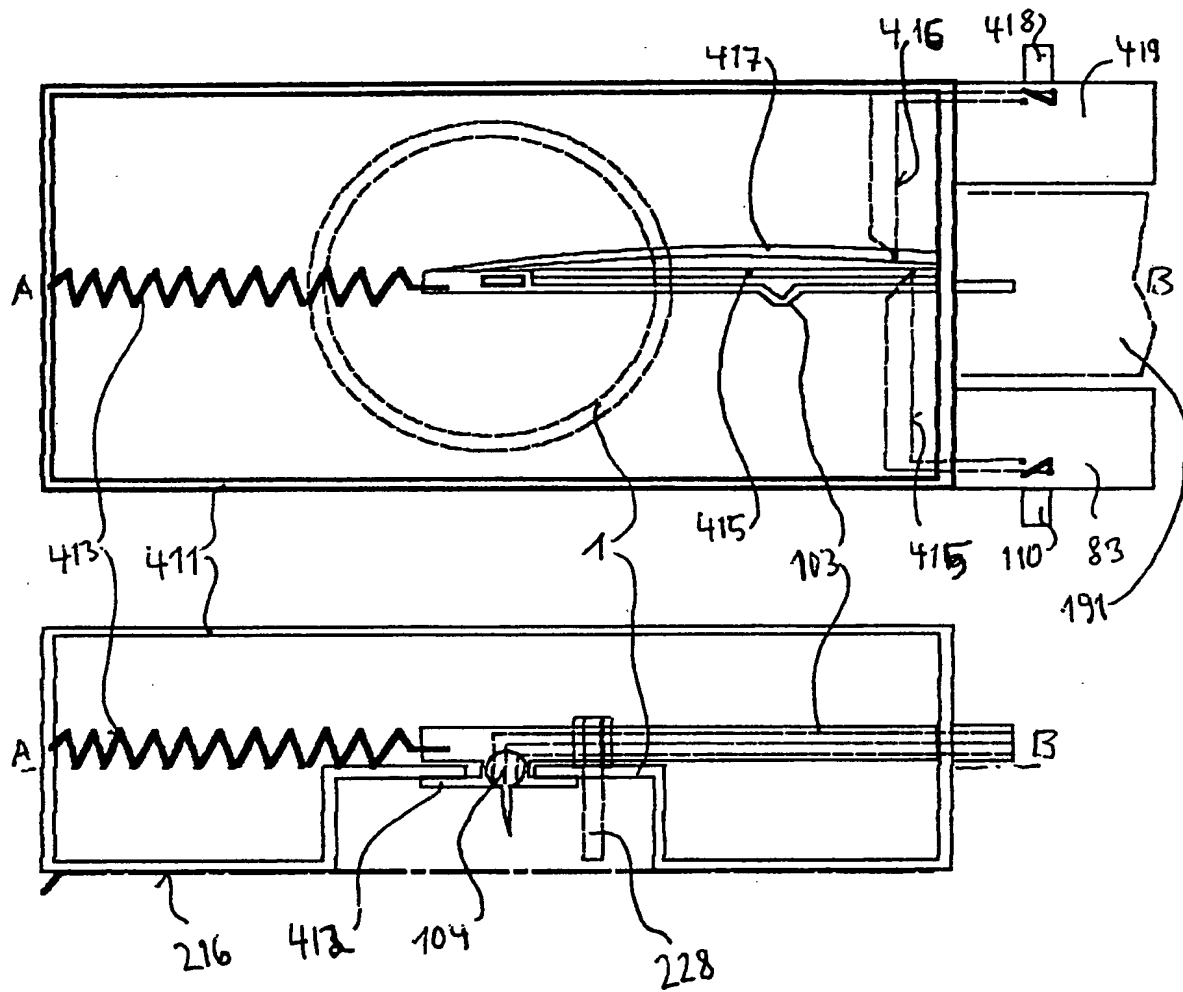


*Fig. 42*

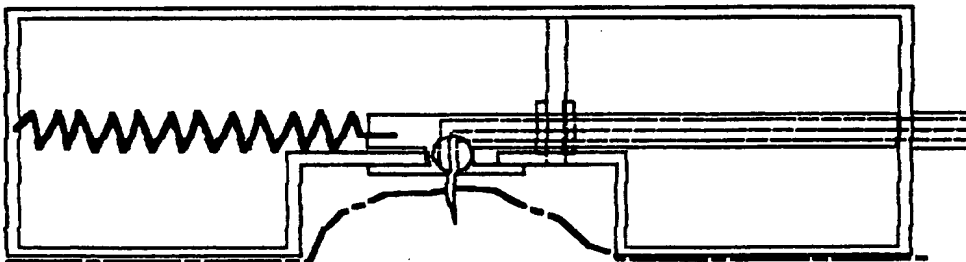


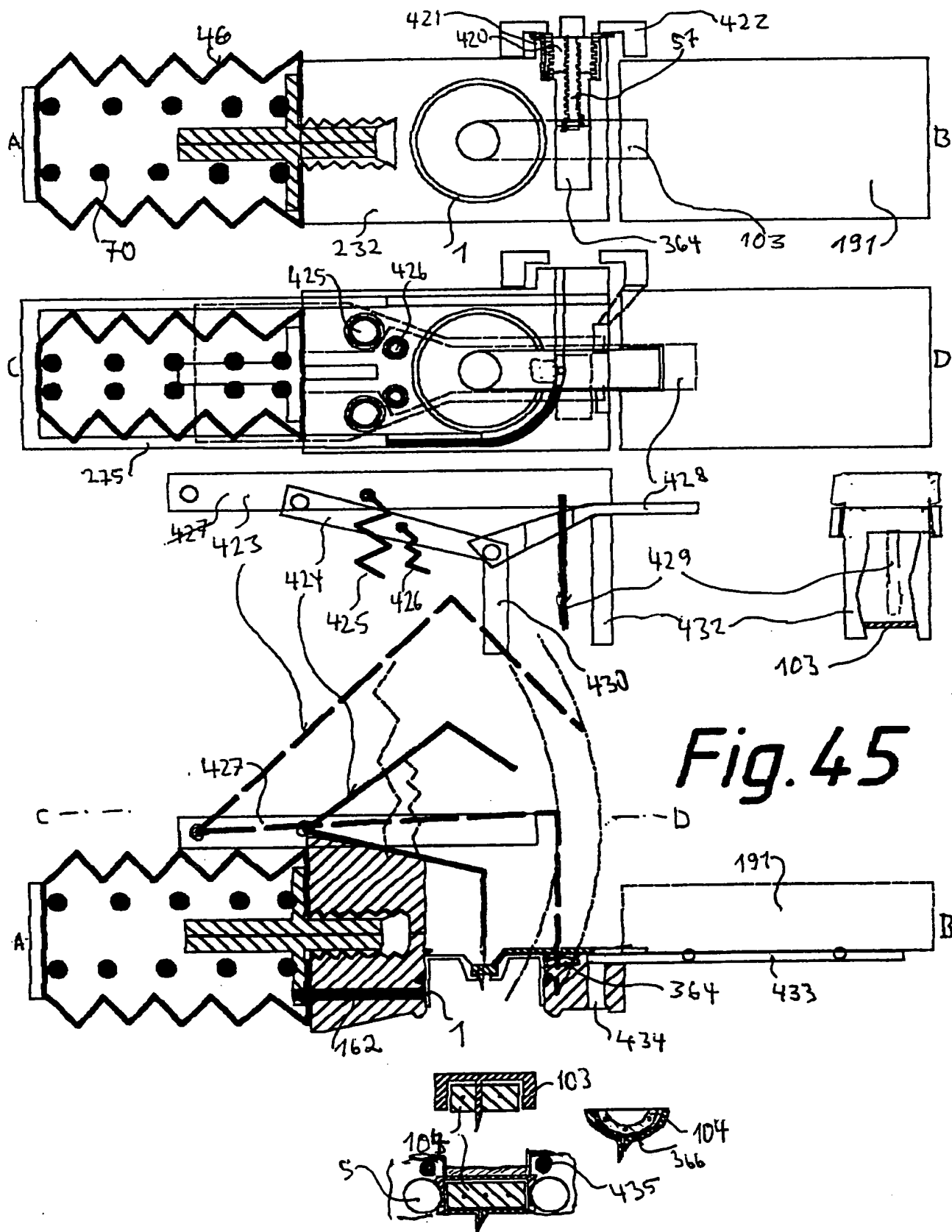


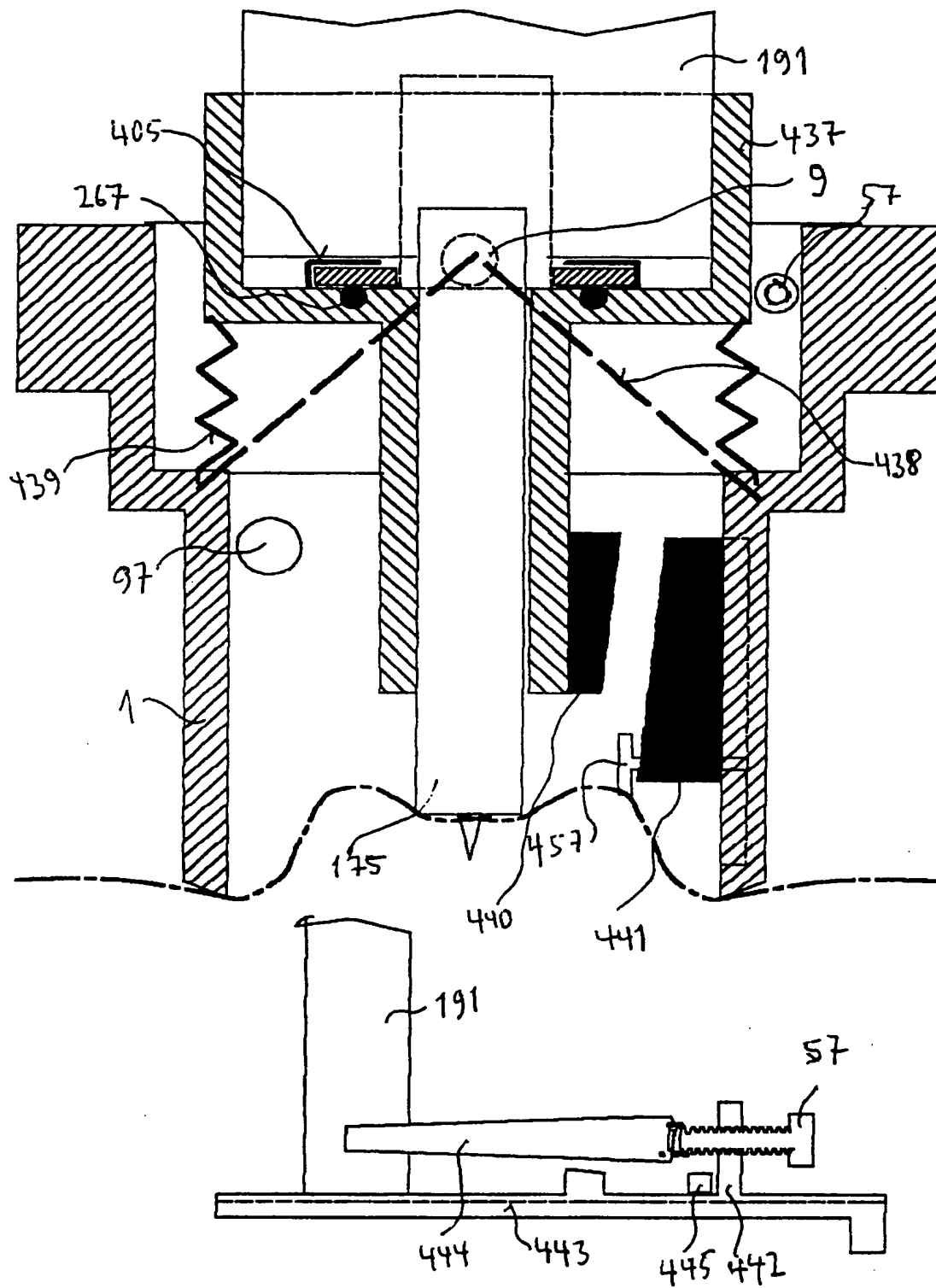




*Fig. 44*







**Fig. 46**